THE ELECTRICAL WORLD
A Weekly Review of Electrical Science

PUBLISHED EVERY SATURDAY

AT NO. 9 MURRAY STREET, NEW YORK.

Telephone Call: Murray 586. Cable Address: "Electrical," New York.

New England Office, 48 Congress Street, Boston.

Philadelphia Office, 1005 Walnut Street.

Western Office, 23 Borden Block, Chicago.

W. J. JOHNSTON, Editor and Publisher.

T. COMMERFORD MARTIN, JOSEPH WETZLER, Associate Editors.

E. P. THOMPSON, Associate Editor Patent Department.

CLARENCE E. STUMP, Business Manager.

SUBSCRIPTION, IN ADVANCE, ONE YEAR, $3.00.

(Postage Prepaid in the U. S. or Canada.)

CLUBS.—In clubs of 4 or more, $2.50 a year each; with a free extra copy to the getter-up of a club of 8.

Subscription to foreign countries, $4 a year.

In requesting your address changed, give **old** as well as new address.

THE ELECTRICAL WORLD HAS THE LARGEST CIRCULATION OF ANY ELECTRICAL JOURNAL PUBLISHED, AND IS THE BEST ADVERTISING MEDIUM.

Advertising Rates are much lower than those of any other similar publication, circulation and standing considered, and vary according to space, position and number of insertions.

Notices of Situations or Help Wanted, $1 to $3 an issue.

Correspondence, views and opinions on all topics within the province of this journal are cordially invited from any part of the world. We will thank readers to forward to us—**promptly** as they occur—**Items of News**, or information relating to any application of electricity, also marked copies of their local papers containing anything likely to interest electricians. Anonymous communications cannot be noticed, nor can rejected manuscript be returned, unless accompanied by the necessary postage when received.

Matter for the **Editorial** Department should be addressed to **The Editor of The Electrical World, New York.**

Subscriptions and communications relating to **Advertising** or the **Business Department** should be addressed to

W. J. JOHNSTON, Publisher,

No. 9 Murray Street, New York,

OR ANY OF THE BRANCH OFFICES.

CONTENTS.

ILLUSTRATED ARTICLES: PAGE.
Some New Electric Indicators ... 139
The New Hochhausen Dynamo ... 141
A New Incandescent Lamp Switch ... 142
The Burnham Automatic Self-Oiling Engine ... 143
A Handy Electric Gauge ... 145
A Novel Wire Cleat ... 145
A New Universal Engine Lathe ... 145
A Regulator for Dynamo Electric Machines ... 145

CORRESPONDENCE:
The Distribution of Magnetism in Electro-Magnets ... 142
Can the Efficiency of a Motor be as high as that of a Generator? ... 142
Mr. Edison and the Incandescent Lamp ... 146
Telephone Induction Coil ... 146
Parallel Telephone Wires ... 146

EDITORIAL PARAGRAPHS ... 137

MISCELLANEOUS:
Electricity in Medical Practice ... 137
Mexican Cable Rates ... 137
The Government Suit against the American Bell Company ... 138
On the Clark Cell as a Standard of Electromotive Force ... 138
Gas and Electricity ... 140
The Best Location for Poles and Overhead Wires ... 141
Responsibility in Telegraphic Transmission of Money ... 142
Localization of Faults in Electric Lines by Means of the Telephone ... 142
A Few Telephone Figures ... 142
Incandescent Lamps for Lighthouses ... 143
The Self-Induction of an Electric Current in Relation to the Nature and Form of its Conductor—Concluded ... 144
The Management of Telephone Companies ... 144
The Goodsell Suit Against the Western Union ... 144
Simultaneous Telegraphy and Telephony ... 144
The Electrolytic Cartridge ... 145
Bleaching by Electricity ... 145
Promotion of Scientific Knowledge ... 146

DEPARTMENTS:
New York Notes ... 146
New England Notes ... 146
Philadelphia Notes ... 146
Western Notes ... 146
Southern Notes ... 147
The Telegraph ... 147
The Telephone ... 147
The Electric Light ... 147
Applications of Power ... 147
Personals ... 147
Miscellaneous Notes ... 147
Sparks and Flashes ... 148
Stock Quotations ... 148
Business Notices ... 148
Our Illustrated Record of Electrical Patents ... 148

New Advertisements.

PAGE.
The India-Rubber and Gutta-Percha Insulating Co.—Wires and Cables ... i
The Lelanché Battery Co.—Special Notice ... ii
Frenyear & Razee—The Exeter Steam Engine ... v
Hartford Steam Boiler Inspection and Insurance Co ... vi
Charles H. Hines—Manufacturing Electrician ... vii
Wanted—Traveling Carbon Points Salesman ... vii
Smith & Rhodes Electric Co.—Electro-Thermic Cut-Off ... vii
Worcester Boiler Works—Steel and Iron Boilers ... vii
Hartford Hammer Co.—Hammers for Electricians ... vii
C. D. Warner—Warner's Patent Electric Gauge ... vii
Western Electric Co.—Annunciators, Fire Alarms and Room Call ... xi
The Consolidated Electric Light Co.—Special Notice ... xii
Elgin Telephone Co.—Special Notice ... xiv

Vol. VII. NEW YORK, MARCH 27, 1886. No. 13.

IT is likely that we shall soon see some practical work done in this country with the Gaulard-Gibbs system of secondary generators, as news comes from England that Mr. George Westinghouse, Jr., has bought the rights for America, and has guaranteed a minimum annual return.

BEFORE a Legislative committee, Mr. Boynton, the auditor of the New England Telephone Company, stated last week that the average total cost to his company of maintaining an instrument was $41.72 a year. And yet some people wonder why the licensees of the American Bell Company want more than $36 a year as telephone rental.

THE operators on one of the lines of railway had their salaries advanced 10 per cent. a few days ago, bringing the amounts up to about the figure at which they stood before the reduction in the days of commercial depression. This was a timely and judicious action, and we hear that it is duly appreciated. In view of the present financial circumstances of the Western Union Company it is hardly to be expected that the company will follow the example thus set, though it might do many a worse thing. The Baltimore & Ohio men are said to be generally satisfied with their treatment.

WE give on the next page an abstract of the bill of complaint presented last Tuesday at Columbus, O., in the suit of the Government against the Bell Company. The bill seems on first reading to be very comprehensive. It contends that Bell on one hand did not observe the formalities sufficiently to obtain or hold a patent, and on the other hand that he secured far more than at most he had a right to take. It gathers up all the various anti-Bell claims that have been in controversy or in litigation for years past, and uses them as a solid battering-ram with which to "break the patent." If the Bell Company wins in this suit, it will have no further troubles. If it lose, there is a likelihood that the business will be open to all comers.

ONCE again the discussion of executing criminals by electricity "bobs up," beginning now with a physician in Buffalo. This mode of execution, which is said to have some advocates, is not one that would add to the popularity of electricity, which we would rather not see put to such a purpose. If, as the Buffalo doctor thinks, it would only be necessary to tap an electric light wire and turn a switch, in lieu of the erection of a gallows, trap-door, etc., our sheriffs would find some of their valuable occupation gone, and we might expect to hear of an outcry from that quarter. By all means let us maintain electricity popular in every respect, and let its death-dealing qualities be the subject rather of cautionary measures than of practical application.

As a retaliatory measure, to offset the resolve of the Central Union Telephone Company not to supply telephones at the rate fixed by law, some of the good people of Lafayette, Ind., want their City Council to order the removal of the telephone poles and wires from the streets. This is a poor way to obtain any redress, and is as little likely to be satisfactory as the attempt of a new telephone company there to give service immediately at the legal rate. The Central Union Company is the sole licensee of the American Bell Company for the region named, and, so far, the courts have held that no other telephones can be used than those for which the American Bell Company controls the exclusive patent rights. Of course, a decision might some day be given against the Bell Company, destroying its monopoly as conferred by the patent law, but at present the situation is simply what we have stated it to be, not only in Indiana, but in every other State.

WE would call special attention to Mr. G. B. Prescott, Jr.'s, description of Mr. Weston's new electric indicators, as the instruments embody numerous features of originality and value. The technical training of persons in charge of most electric light plants is not usually of such character that delicate apparatus can be intrusted to their care, and hence, too often, the lack of refinement in the electrical apparatus used means an approach to danger before the attendant is aware of the fact. For example, an increase of only a few volts in the potential of an incandescent circuit means a shortening of the life of the lamps, and the danger increases in a rapid ratio with the rise in electromotive force. In the potential indicator of Mr. Weston, a small variation from the standard potential causes a large range of movement of the pointer, and thus draws immediate attention to impending danger. There being no permanent magnets employed in its construction, its accuracy remains unchanged with the lapse of time. This feature is eminently valuable where hundreds of lamps are dependent upon such an apparatus. In the same way the current indicator in which the gradations are equidistant over a large range of current strength, will go far toward attracting an attendant's notice to the abnormal condition of affairs signaled.

NOTWITHSTANDING the exhaustive trials recently concluded by the English lighthouse authorities, and in which the arc light proved itself the superior over gas and oil, M. Felix Lucas now comes forward with an interesting argument in favor of the incandescent electric lamp for lighthouse purposes. The South Foreland experiments above referred to seem to show that, especially in a fog, the penetrating power of a light to a certain extent depended more upon the intrinsic brightness or brilliancy of the source of light than upon its candle-power. It would be difficult to reconcile this fact with M. Lucas' preference for the incandescent light, for to obtain such brilliancy in the latter would mean its rapid destruction. The other arguments in its favor, however, are interesting and deserve consideration. In studying the question, M. Lucas gives an explanation of the causes which lead to the deposition of carbon upon the sides of the bulbs of incandescent lamps. The remedy which he suggests can hardly be called new, but still we are not aware that it has been applied in actual practice, desirable as it appears to be. Thus far, the absorbent materials have only been employed during the process of manufacture of the incandescent lamp, but it would not seem to be difficult to introduce permanently into the lamp a suitable absorbent of oxygen. There is here a chance for improvement and inventive genius.

THE new policy of gas corporations with regard to the electric light is making itself seen and felt in many places. At one time, and not so long ago, the electric light was to be fought and to be resisted as a bad thing; to-day gas companies all over the country are either organizing to operate as electric light companies or are avowing their readiness and willingness to furnish electric light to any persons who may want it. As we remarked lately, this change of front has its benefits. There is no reason why gas companies should not be able to do a profitable electric light business, if they will only take hold of it in the right spirit and "push things." The western gas companies appear particularly desirous to give the electric light an honest trial, and we understand that Chicago is the headquarters of at least one new and influential organization whose object is to introduce electricity through the agency of corporations already doing a gas-lighting business. It is early yet to pronounce very decidedly on the coming developments in this direction.

ECONOMY of wire in the running of electric light circuits is a most commendable end to be striven for, but when it entails dangers from any cause it cannot be too strongly condemned. One of the methods of economizing wire in the installation of electric light on iron ships has been to use the iron skin of the ship as a return, thus practically employing only one wire. The effect of this plan, as might be supposed, has in some cases turned out to be disastrous to the accuracy of the compass, a recent case, again, having shown that the needle was deflected five degrees by the presence of the current. The remedy here is obvious, being simply the resort to two wires, a lead and return. Where these are laid side by side their influence is practically *nil* upon the needle—the currents in them being in opposite directions. But the single wire system appears to us objectionable on still another ground, and that is, the liability to corrosion of the iron, due to galvanic action. It is evident that where the whole side of a ship constitutes a conductor, a difference of potential must necessarily exist in its various parts. Hence, if this difference of potential be only two volts—*i. e.*, great enough to decompose water—galvanic action will begin, causing the dissolution of the iron plates on that part of the ship's skin which is at the higher potential. Continuous action of this nature must eventually cause the collapse of the iron plates. While we advise, therefore, the use of the double wiring, it is evident that the latter, for the very reason given above, should be done with exceptional care as to insulating properties, because two grounds from opposite leads would greatly magnify the danger cited above. However, with good insulation and with regular periodic tests for the detection of any faults which may develop, there need be no more apprehension of danger from this cause on ship board than there is from fire through overheating of the wires.

Electricity in Medical Practice.

At a recent meeting of the French Academy of Medicine, M. Brondel read a paper on the introduction of certain medicines into the system by means of electricity. If the electric current is made to pass through a solution of a salt, the salt is decomposed, the metallic base passing to the negative pole, and the acid, or metalloid, to the positive pole. The iodides are easily decomposed by electricity. In order to introduce iodine into the system, a rubber plate, moistened with a solution of iodide of potassium, is placed upon the surface of the body. Over this plate the negative pole of a battery is applied, while the positive pole is placed upon a part of the body toward which it is desired that the iodine should travel. The iodine separates from the potassium, which remains at the negative pole, and passes with great rapidity through the tissues towards the positive pole. This may be demonstrated by testing with a starched paper, which becomes blue. A great number of substances can thus be made to traverse the tissues, and the applications of this discovery are numerous and important.

Mexican Cable Rates.

The Mexican *Financier* says the Cable company has made new rates as follows: To Galveston and New Orleans, first ten words $2.50, and 20 cents each additional word. To Texas and Louisiana, excepting Galveston and New Orleans, $3, and 25 cents each additional word. All other points in the United States $3.25, and 25 cents each additional word. All other rates unchanged. The above rates are from Mexico, Tampico and Vera Cruz. It likewise says: The Mexican Central Railway has made a reduction in telegraph tolls as follows: To points in the United States, except in Louisiana, Texas and the Indian Territory, for the first 10 words $3.25, each additional word 25 cents. To Louisiana and Texas (except New Orleans and Galveston) and Indian Territory, $3, each additional word 25 cents. To New Orleans and Galveston, 10 words, $2.50, each additional word 20 cents. To all points in Sonora, ten words $3.50, each additional word 35 cents, Cable service—To Great Britain, Ireland, France, Germany and Belgium, 90 cents each word. To Austria, Holland Denmark and Italy $1 per word. To Havana 80 cents a word

The Government Suit Against the American Bell Company.

The petition or bill of complaint in the suit brought by the United States Government to annul and vacate the Bell telephone patents was filed March 23 in the United States Circuit Court, at Columbus, O., by District Attorney Kumler. Process was issued also directing appearance by the defendants by May 1, and requiring the answer to be filed on or before June 1. The petition with its accompanying exhibits fills a large printed pamphlet. On the question of the jurisdiction of the court in Ohio, the bill is explicit, and it is understood that this will be the first question that will be discussed in connection with the case. The local council retained by the Bell people are Messrs. Taylor & Taylor.

In the bill of complaint the United States of America appears as complainant, the respondents being thus described: "The American Bell Telephone Company, a corporation under the laws of Massachusetts; The Central Union Telephone Company, a corporation under the laws of Illinois; The Erie Telephone and Telegraph Company, incorporated under the laws of the State of Massachusetts; The Central District and Printing Telegraph Company, incorporated under the laws of Pennsylvania; The Cleveland Telephone Company, The City and Suburban Telegraph Company, The Miami Telephone Company, The Buckeye Telephone Company—the latter four companies incorporated under the laws of Ohio—and Alexander Graham Bell." The bill is one in equity and is addressed to the Judges of the United States Circuit Court for the Southern District of Ohio, Eastern Division. The counsel appearing for the government in the matter are Solicitor-General Goode, acting for the Attorney-General; Philip H. Kumler, United States District Attorney for the Southern District of Ohio, and these special counsel: Messrs. Allen G. Thurman, Grosvenor P. Lowrey, Hunton & Chandler, and Charles S. Whitman. The Solicitor-General acts for the Attorney-General in the matter, it is explained, because of the latter's disability to prosecute.

As might be expected, the bill covers ground that is familiar to every one acquainted with telephonic history and litigation. Dealing with the well-known claim of Gray to priority and the use of deceit against him in 1876, the complaint sets forth:

"That the said Bell, having unlawfully obtained certain information as to essential features of the invention of Gray as disclosed by his caveat, proceeded without delay to make substantial amendments of his specification and claims, which amendments were made on the 29th day of February, only four days after said withdrawal of notice was communicated to said Gray; that such amendments related to such parts of said Bell's alleged invention which he and his assigns have since claimed as the cardinal element or feature of his patent, to wit, the transmission of sounds by gradual or undulatory changes in the electrical current as distinguished from alternate or pulsatory changes; that in the notice of the 19th of February, 1876, the said examiner had distinctly advised the said Gray that the application of Bell seemed to conflict with his caveat in respect to the method of producing the undulations by varying the resistance of the circuit and the method of transmitting vocal sounds telegraphically by causing these undulating currents; that this same examiner, without the knowledge of the said Gray, communicated to Bell the fact that Gray's invention varied the resistance and produced undulations by means of a liquid transmitter; that upon and in consequence of this surreptitious information, and of the unlawful communications respecting the said caveats made to the said Bell, as herein above alleged, the said Bell made the said amendments, more clearly defining the distinction between pulsatory and undulatory currents, and substituting the word 'gradually' for 'alternately' wherever it occurred in one of his claims; and your orator charges that these amendments were substantial, as well in themselves as in their bearing upon the rights then secured by Gray under the statute, and were not verified by oath, and that the said patent was issued thereon and during the pendency of said caveat, and with undue and unusual haste, and without proper consideration of the rights secured by said Gray, or of the interest of the citizens of the United States with respect to the art of telephony sought to be monopolized by said Bell.

"And your orator further shows that the said Bell ingratiated himself into the favor and confidence of the attorney of said Gray, and in order to induce the said Gray to abandon his caveat did, as early as March 8, 1876, and before his said patent was issued, falsely and fraudulently cause said attorney to believe that he (Bell) had invented a speaking telephone prior to the said Jan. 20, 1876, and also that such invention was really described therein, and induced said attorney so to represent to said Gray; and that accordingly the said attorney, by letter of March 3, 1876, caused the said Gray to be informed that the said Bell had the older and better claim, and gave it as his 'judgment' that it would not be advisable for the said Gray to press his claim for the invention.

"Your orator shows, on information and belief, that said Gray believed these false suggestions, and was thereby induced to take, and did take, no action in pressing his said caveat for a patent for many months, and until long after said Bell had secured his said patent upon his said application, and that by these wrongs and frauds aforesaid, and others to be presently stated, said Bell succeeded in securing the aforesaid patent for an invention of great value which he did not discover, and to which, as between him and said Gray, the said Gray was entitled to priority."

The examiner regarded Bell's application as one for an improvement in multiple telegraphy. His opinion was that Bell's application and Gray's caveat interfered on principles employed in harmonic or multiple telegraphy, but not in the art of transmitting speech. Bell's language and drawing gave no intelligible notice that one portion of his specification related to telephony, which had come in general use as the term for denoting the transmission of speech by means of electricity. It was on March 10, 1876, three days after the patent was issued to him, that Bell obtained for the first time articulate speech by an electric speaking telephone. This was not achieved, it is also alleged, with any device or apparatus described in his specification and patent, but was obtained by the liquid transmitter or water telephone described in Gray's caveat and derived by Bell from the latter. Bell's devices, up to the time of filing his application, did not transmit and deliver articulate speech. He did not intend so to operate them nor was he aware that they would do so. There is not and never was, it is declared, an electric speaking telephone in use made in accordance with Bell's alleged invention, and the instrument used by the American Bell Company was not invented or discovered by Bell, "nor did he invent or discover any essential part or principle of the same." The instruments are declared to be combinations of the inventions of other persons, some made before and some since Bell's alleged discovery. These facts showing fraud, it is stated, long remained artfully concealed and have only recently been brought to the knowledge and attention of the prosecutor.

Another point offered is that even if Gray's caveat had not been filed and Bell's patent had been properly issued as for the improvement in telegraphy described in it, it would still be void and ineffective to secure any exclusive claim for the art of transmitting audible speech by the process set forth in the fifth claim of Bell's patent, because all his claims are bad in form and substance and void as a matter of law. The fifth claim is for the method of and apparatus for transmitting vocal and other sounds telegraphically by causing electrical undulations similar in form to the vibrations of the air accompanying the sounds. This is declared to be void, because the words "method of" merely describe the function and mode of operation of the machine. The claim for an "apparatus" is void because no mechanical device is specified. The claim of causing undulations in a particular supposed form is a mere matter of speculation, and is not the subject of a patent. The transmission of vocal sounds by electricity was notoriously old, and there is no attempt to claim a more perfect transmission electrically. The patent, furthermore, is void because it does not point out and distinctly claim a new and useful art, machine, manufacture, or composition of matter, but attempts to include in a patent and claim the alleged invention of an art and a machine. It unlawfully attempts to cover by a patent the function performed by an apparatus and an abstract principle and law of nature. The patent, also, is a fraudulent attempt on Bell's part to enable him and his assigns, by the aid of their vague and general descriptions, to avail themselves of subsequent discoveries and inventions and interfere with other inventors. Bell in his specification and claim nowhere pointed out or described any apparatus or device or means for carrying his pretended invention into effect in such a way that the same can be constructed or operated by others.

Among those for whom the bill claims the invention of the telephone in a manner detrimental to Bell are James W. McDonough, Daniel Drawbaugh, Elisha Gray, Thomas A. Edison, Amos E. Dolbear, Philip H. Van der Weyde, Adolph Ott, W. F. Channing, Benjamin F. Edwards, James Hamblett, Jr., Edward Farrar, Antonio Meucci, W. S. Vollker, Edward E. Pickering, Charles R. Cross. Alfred C. Holcomb, Ellen C. Holcomb, Philip Reis, Royal E. House, David Hughes, Asahel K. Eaton, Dr. S. D. Cushman, Signor Mouzetti, Paul La Cour, Prof. Yates, and Cromwell Fleetwood Varley.

The bill relates not only to the earlier Bell patent of March 7, 1876, No. 174,465, but that of Jan. 30, 1877, No. 186,787, covering telephonic devices alleged to be existing and well known, and, particularly, to have been invented by Professor Dolbear, whose work is duly described, as well as the manner in which he is said to have been unfairly induced to abandon his case and his experiments.

The present proceeding is declared to have been instituted because the complainant "is remediless in the premises under the rules of the common law, and can only have relief in this form of proceeding." The prayer of the complaint is that the defendants make answer to the complaint; that the Bell patents be declared null and void; that it be declared that the patents were wrongfully procured to be issued by means of fraud, false suggestion, concealment, and wrong on the part of Alexander Graham Bell, and that there is nothing in the patents or specifications on which a monopoly of a patentable invention could have been lawfully granted to him, and that the patents be repealed and the record of them be expunged; that the original letters patent be surrendered to the court, so that the Patent Office seals may be removed or destroyed. If, however, the court should determine that the patents are not wholly void and not deserving to be wholly repealed, but are merely partly so, a decree is asked for repealing such parts as the court may deem void, "and that the said patents and each of them be treated as contracts and be re-formed, limited, and modified as in equity and good conscience they ought to be." An injunction is also asked restraining the defendants, their agents, etc., from setting up any pretense or claim under the Bell patents, or from pleading these in judicial proceedings as evidence of any grant or right conferred on Bell or his assignees.

The defendants are cited to enter appearance by May 1, and to file answer on or before June 1. It does not seem likely, therefore, that any further action will be taken in the case before that time.

The government counsel seem confident that they will be allowed to prosecute the suit in the court selected, but even should that point be gained, there must be many delays before the case can reach a settlement. The time likely to be occupied in hearing the suit is set by some persons at not less than two or three years.

On the Clark Cell as a Standard of Electromotive Force.*

BY LORD RAYLEIGH, F. R. S.

This paper, supplementary to that "On the Electrochemical Equivalent of Silver, and on the Absolute Electromotive Force of Clark Cells" (*Phil. Trans.*, Part 2, 1884), gives the further history of the cells there spoken of, and discusses the relative advantages of various modes of preparation. The greatest errors arise from the liquid failing to be saturated with zinc sulphate, in which case the electromotive force is too high. The opposite error of *super*-saturation is met with in certain cases, especially when the cells have been heated during or after charging. Experiments are detailed describing how cells originally super-saturated have been corrected, and how in others the electromotive force has been reduced by the occurrence of super-saturation consequent on heating. If these errors be avoided, as may easily be done; if the mercury be pure (preferably distilled *in vacuo*); and if either the paste be originally neutralized (with zinc carbonate), or a few weeks be allowed to elapse (during which the solution is supposed to neutralize itself), the electromotive force appears to be trustworthy to $\frac{1}{1000}$ part. This conclusion is founded upon the comparision of a large number of cells prepared by the author and by other physicists, including Dr. Alder Wright, Mr. M. Evans, Dr. Fleming, Professor Forbes and Mr. Threlfall.

As regards temperature co-efficient, no important variation has been discovered in saturated cells, whether prepared by the author or by others. In all cases we may take with abundant accuracy for ordinary applications—

$$E = 1.435 \left\{ 1 - 0.00077\,(t - 15^\circ) \right\}$$

the temperature being reckoned in centigrade degrees. For purposes of great delicacy it is advisable to protect the standards from large fluctuations of temperature. Under favorable circumstances two cells will retain their relative values to $\frac{1}{1000}$ for weeks or months altogether.

Unless carefully closed up, the cells lose liquid by exudation and evaporation, and then the electromotive force gradually falls. Marine glue appears to afford a better protection than paraffine wax, and there seems to be no reason why cells thus secured should not remain in good order for several years.

In cells of the H-construction the leg containing the amalgam (but not the one containing pure mercury) is liable to burst, apparently in consequence of a tendency to alloy with the platinum. Protection with cement of the part of the platinum next the glass has been tried, but no decisive judgment as to the adequacy of this plan can as yet be given.

Recent cells, intended for solid zincs, have been made of a simplified pattern—nothing more, in fact, than a small tube with a platinum wire sealed through its closed end. The zincs are not recast, and the paste is prepared from (unwashed) mercurous sulphate rubbed up in a mortar with *saturated* solution of zinc sulphate and a little zinc carbonate. A stock of paste may be prepared and retained for use in a bottle.

Experiments are described tending to prove that the irregularities observed during the first few weeks of the life of a cell prepared with acid materials have their origin principally at the mercury electrode.

Cells prepared with dilute solutions have a lower temperature coefficient (about 0.00038), but would be more difficult to use as standards, whose value is to be inferred from the mode of prepration.

Details are given of H-cells charged with amalgams of zinc and mercury in both legs, without mercurous sulphate. A very small proportion of zinc is sufficient to produce the maximum effect. Pure mercury, neither alloyed with zinc nor in contact with mercurous sulphate, has an uncertain electromotive value.

Since the comparison of cells does not absolutely exclude a small general alteration of electromotive force with age, further determinations of the standard cell (No. 1) have been effected by means of the silver voltameter. The results—

Date.	E. M. F. of No. 1 at 15° C. in B. A. volts.
October, 1883, to April, 1884	1.4542
November, 1884	1.4540
August, 1885	1.4537

are very satisfactory, and indicate a constancy sufficient for almost all practical purposes.

Finally, some comparisons are given between Clark cells and Daniells, with equi-dense solutions, both of Raoult's pattern and of that described recently by Dr. Fleming.

* Abstract from a communication to the Royal Society, Jan. 21, 1886.

Some New Electric Indicators.

BY GEORGE B. PRESCOTT, JR.

It is certainly within the bounds of reason to say that the pressure gauge is not more essential to the fireman under instructions to keep a uniform pressure of steam in his boiler, than is the potential indicator to the dynamo engineer who is expected to maintain a constant difference of electric potential at the terminals of his incandescent lamps. The current indicator is likewise a necessity in the arc light circuit requiring an invariable current, while the current meter is indispensable in all large incandescent installations where a varying load makes it necessary, for economical reasons, to vary the number of active dynamos to correspond with the number of lamps in use. The automatic regulation of both current and potential in all complete systems of arc and incandescent lighting, respectively, no more does away with the necessity for using such instruments than the automatic steam damper abolishes the use of the steam gauge. The terms indicators and meters are used in their limited sense, it being understood that only integrating instruments are, properly speaking, quantity meters.

The conditions under which such instruments are used in commercial electric lighting are very different from those met with in scientific research or in ordinary experimental work, and the sensitive reflecting galvanometers, electro-dynamometers, etc., of the laboratory, which may be shunted and combined with external resistance to measure electrical quantities with accuracy through an almost limitless range, are worthless in the electric light station. The reason is obvious, and it will suffice to say that the requirements for an electric gauge which is to guide the ordinary dynamo man are, that it shall be as simple and as reliable as the steam gauge which guides the fireman.

These demands have naturally brought forth many new instruments designed to fulfill the imposed conditions, and although some of those which have been devised during the past few years have been better than others, it is, perhaps, safe to say that none has proved entirely satisfactory. Some instruments which have recently been devised by Mr. Edward Weston, for use in connection with his arc and incandescent systems, appear to be free from the defects common to apparatus of their class, and are worthy of special attention. They are respectively a potential indicator, a current indicator and a current meter, and are of somewhat later date than the coulomb and current meters devised by Mr. Weston about two years ago, and which were recently* described in this journal.

As it is sometimes both interesting and instructive to follow the experiments which have finally led to the adoption of a specific form of apparatus, it may be worth while to preface a description of Mr. Weston's perfected potential indicator by a brief explanation of the earliest form of this indicator, and of the difficulties met with therein. This instrument, of which Fig. 1 is a perspective view, Fig. 2 showing a section and details of construction, is, in general principle, a modified form of the well-known siphon recorder, and is novel only in its application and in details of construction. It consists of a coil of wire wound on a rectangular frame *H*, and suspended between the poles of an electro-magnet; the pole pieces of this magnet are broad enough to allow of the full movement of the coil in a uniform field. Inside the coil, for the double purpose of reinforcing the field and making it uniform, a cylinder of soft iron *G* is supported. The wires *b b*, forming a bifilar suspension, serve also as current leads; they pass through the cap *B*, by means of which they may be raised or lowered and given the proper orientation. The yoke *E*, which carries the tube *A* and its cap, is sustained by the pole pieces. The frame *H*, for the suspended coil, is stamped out of sheet copper, bent into rectangular form, and has the ears turned up to hold the wire in place. The movement of the coil is magnified by the pointer *N*. To avoid heating, the field magnet is wound with very fine German silver wire, while the armature is wound with still finer copper wire in order to get a large number of turns in the limited space without causing any greater rise of temperature than occurs in the field wire. The field and armature wires are connected in series and brought to the terminals in the base of the instrument, as shown at the right in Fig. 1. When these terminals are connected to the mains, the magnets become energized and tend to repel and attract the currents circulating in the armature in such a manner as to cause the coil to assume a position at right angles to that of the pole-pieces. The cap *b* is then turned in a direction opposite to that in which the coil has moved, causing the suspending wire to twist and slightly raise the coil —thus introducing a force opposed to that of the magnet. When these two forces are equal, the coil stands in the plane of the pole-pieces and the pointer indicates zero, or normal potential, at which, of course, the adjustment is first made. With a decrease or increase of potential it is deflected to the left or right respectively, the slightest change being instantaneously indicated with very little oscillation, as the copper frame of the coil acts as an effectual damper. Any increase or decrease of potential not only increases or decreases the current in the coil, but also increases or decreases the strength of the magnet as well, so that the resultant changes are pro-

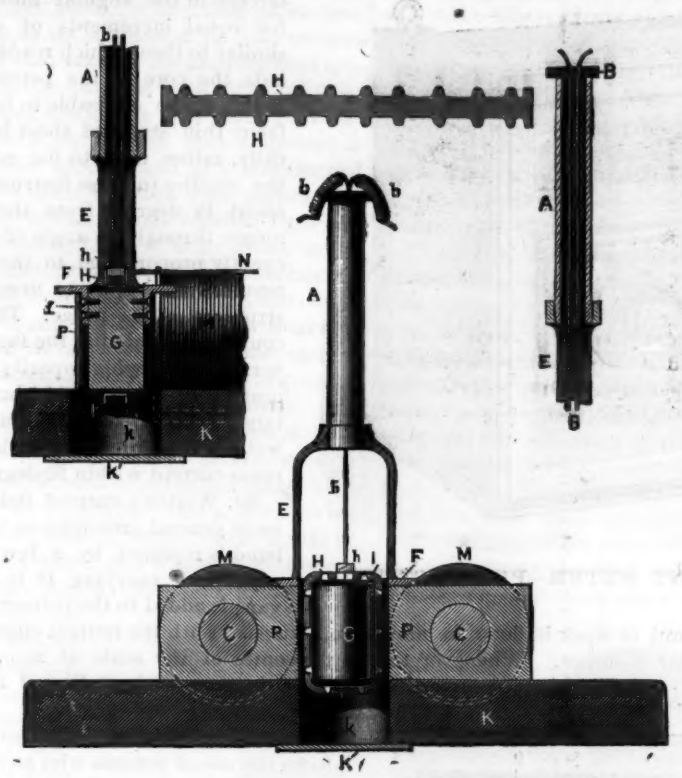


FIG. 2.—WESTON'S BIFILAR SUSPENSION POTENTIAL INDICATOR—SECTION AND DETAILS.

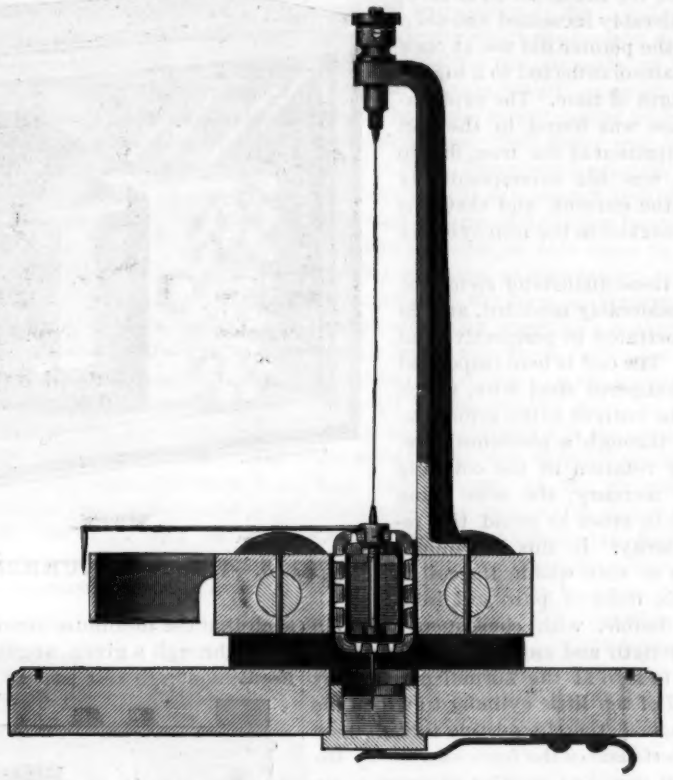


FIG. 4.—WESTON'S UNIFILAR POTENTIAL INDICATOR—SECTION.

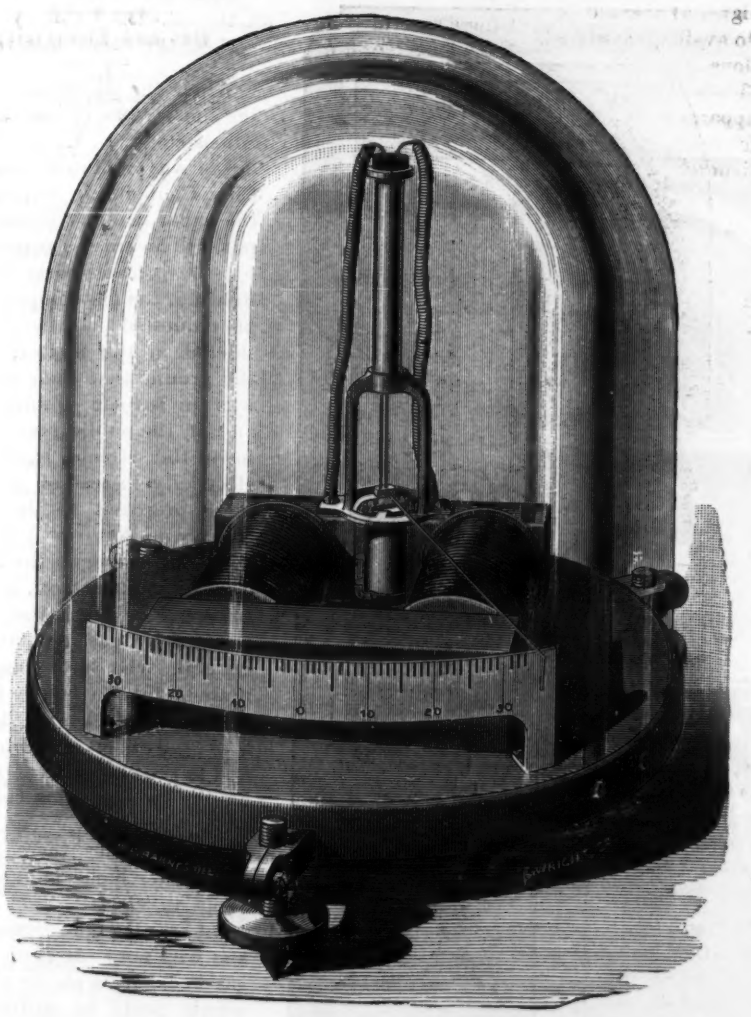


FIG. 1.—WESTON'S BIFILAR SUSPENSION POTENTIAL INDICATOR—PERSPECTIVE.

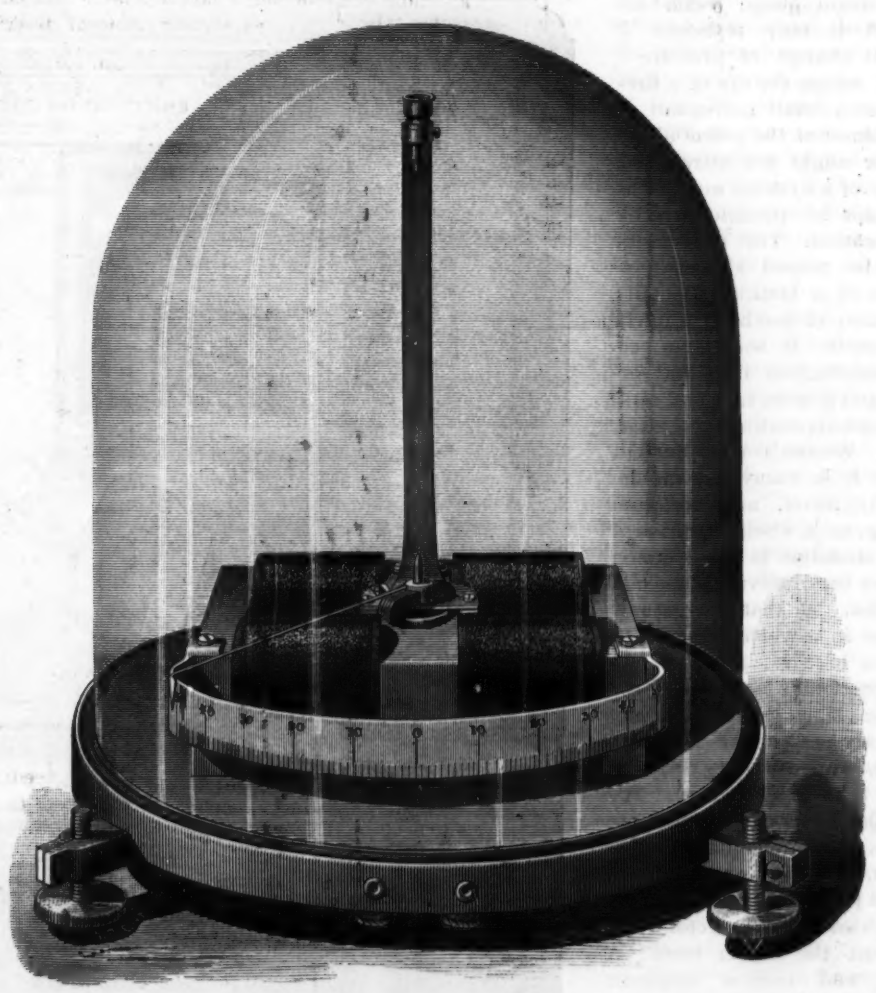


FIG. 3.—WESTON'S UNIFILAR POTENTIAL INDICATOR—PERSPECTIVE.

* ELECTRICAL WORLD, March 13.

portional to the square of the current, and therefore very great.

In practice it was found that in order to obtain the required sensibility it was necessary to turn the cap several times around, in fact to actually twist the wires together, and that this condition impaired the reliability of the instrument for long continuous use. It was noticed also that if, while the needle stood at zero, the potential was considerably increased and then reduced to the normal, the pointer did not at once return to zero, but remained deflected to a higher point a considerable length of time. The explanation of this phenomenon was found in the fact that the greater magnetization of the iron, due to the increased current, was not correspondingly reduced on decreasing the current, and that this effect was particularly marked in the iron cylinder or armature core.

In order to eliminate these disturbing elements, the instrument was considerably modified, and in its perfected form is illustrated in perspective and section in Figs. 3 and 4. The coil is here suspended by a single, carefully tempered steel wire, which serves also to conduct the current to the armature. The current is led out through a platinum wire, continuing the axis of rotation of the coil, and dipping into a cup of mercury, the wire being small and the cup large in order to avoid the retarding effect of capillarity. In this instrument the stationary cylinder or core within the coil is built up with very thin discs of pure soft iron, and the magnets are double, with consequent poles, in order to increase the strength and uniformity of the field. The pointer is brought to zero at the normal potential by turning the milled head of the little cylinder to which the suspending wire is attached, thereby putting torsion upon the latter until it counterbalances the force exerted by the current. The laminated core and unifilar suspension appear to completely eliminate the disturbing elements remarked in the first form. In the present instrument the only element possibly subject to change with time is the suspending wire, but months of experience have demonstrated that long, slender steel wires under small torsion are practically unaltered, and they certainly ought to be more constant than the hair spring of a chronometer. In other respects this indicator is the same as the first form. A variation of one volt produces a movement of the index equal to about 10 divisions of the scale, or degrees, and this great sensitiveness is a desideratum; for, just as a movement of one-tenth of an inch of a steam guage index—although it may represent 5 pounds change of pressure—might escape the eye of a fireman, so a small movement of the pointer of the potential indicator might not attract the notice of a dynamo man, or at east not be thought worthy of attention. This instrument may be placed almost anywhere in a station, the only condition of use being a fairly firm shelf. It has given perfect satisfaction in actual service, and it must take first rank amongst apparatus of its class.

Mr. Weston's new current meter is in many respects decidedly novel, and its simplicity, as a whole, surprising. Its foundation is the common copper band galvanoscope laid on end, so that the needle moves in a vertical plane, as shown in Figs. 5 and 6. In this particular instrument the copper band has a current capacity of about 500 ampéres, and is bent back on itself with a short turn. The parallel arms of the band are less than one-quarter inch apart, and their ends are fastened to large blocks of brass which serve as connectors, and support the copper band A long and narrow magnetic needle is pivoted in the centre of the band, equidistant from the two arms, and is normally maintained in a horizontal position by a weighted pendulum rigidly fastened to the centre of the needle at right angle to its length. Heavy blocks of soft iron are attached to the outer sides of both arms of the copper strip in such a position as to inclose the needle. The movements of the latter are magnified in the usual manner by means of an aluminium pointer.

The action of the instrument is very simple: When no current is passing, the pendulum hangs vertically, the needle is horizontal, and the pointer, forming an angle with the needle, points to zero on the scale. It will be observed that while the position of the needle is such, a current passing through the band cuts the maximum number of its lines of force, and that in this position a given current will tend to move the needle through the greatest angle; on the other hand, the position of the pendulum is such that the minimum amount of work is done in moving it through a given angular distance. Whenever the needle comes to rest at any point, these two forces are balanced, but as with increasing current the needle is moving into positions where fewer and fewer of its lines of force are cut by the current, while at the same time, with equal angular movements, the pendulum is being lifted through greater vertical distances, it is evident that with uniform increments of current, the angular movement of the needle would grow less and less. The iron blocks, however, exert an influence exactly opposite in effect to that just described. To illustrate this action, let it be supposed, while facing the indicator as shown in Fig. 5, that the left end of the needle is a south pole; then the current which tends to move that pole of the needle upward, at the same time magnetizes the iron blocks vertically with north poles at the top. As the current increases, not only do the iron blocks become more strongly magnetized, but the poles of the needle more closely approach the opposite poles of the iron blocks, by which they are, therefore, more and more strongly attracted; thus it is only necessary to suitably proportion the iron blocks in order to exactly counterbalance and neutralize the difference in the angular movements of the needle for equal increments of current. For reasons similar to those which made it necessary to laminate the core of the potential indicator, it was found to be advisable to build up the iron blocks from thin strips of sheet-iron laid together vertically, rather than to use solid blocks. By giving the needles in these instruments an initial set of about 45 degrees from the horizontal, its movements through an angle of 90 degrees are almost exactly proportional to the strength of the current, a result hitherto unaccomplished in any instrument of its range. The instruments are, of course, calibrated at the factory in the usual manner. The carrying capacity of these meters is only limited by the size of the copper strip; in the larger meters the pendulums are more heavily weighted in order to keep the deflection with maximum current within 90 degrees.

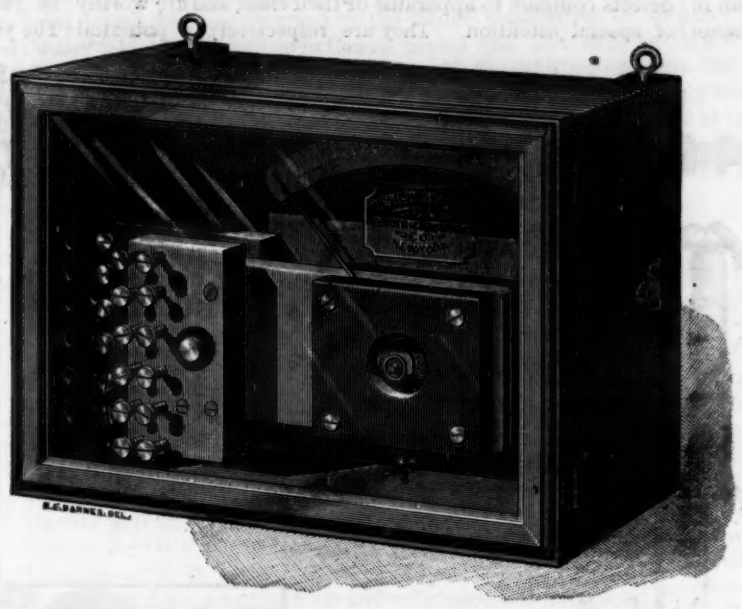


FIG. 5.—WESTON'S CURRENT METER—PERSPECTIVE.

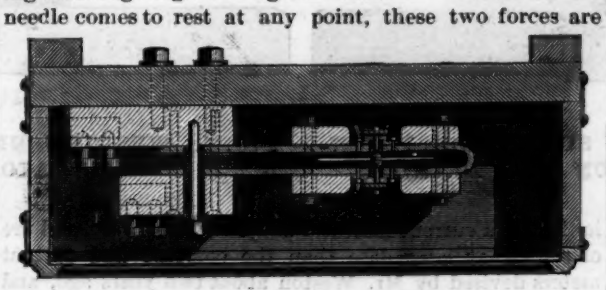


FIG. 6.—WESTON'S CURRENT METER—SECTION.

Mr. Weston's current indicator is built on the same general principles as the meter. The copper band is replaced by a few convolutions of wire capable of carrying 10 to 20 ampères, and an air vane is added to the pointer to prevent too rapid oscillations. With the normal current, the pointer stands in the centre of the scale at zero, and any increase or decrease in current is indicated by a right or left deflection.

A small-range meter is also constructed on the same principle for the use of persons who have occasion to measure currents of 20 ampères or less.

For large incandescent installations, the meters are mounted in groups on boards, with suitable circuit breakers for switching the dynamos in and out as required. A section of one of these boards containing two indicators and switches is illustrated in Fig. 7, the indicator at the left being shown out of circuit.

That the above described indicators and meters fulfill the requirements for electric gauges for station use, to which I have previously directed attention will, I think, be readily admitted, and it may be mentioned incidentally that the most reliable indicators make the best regulators.

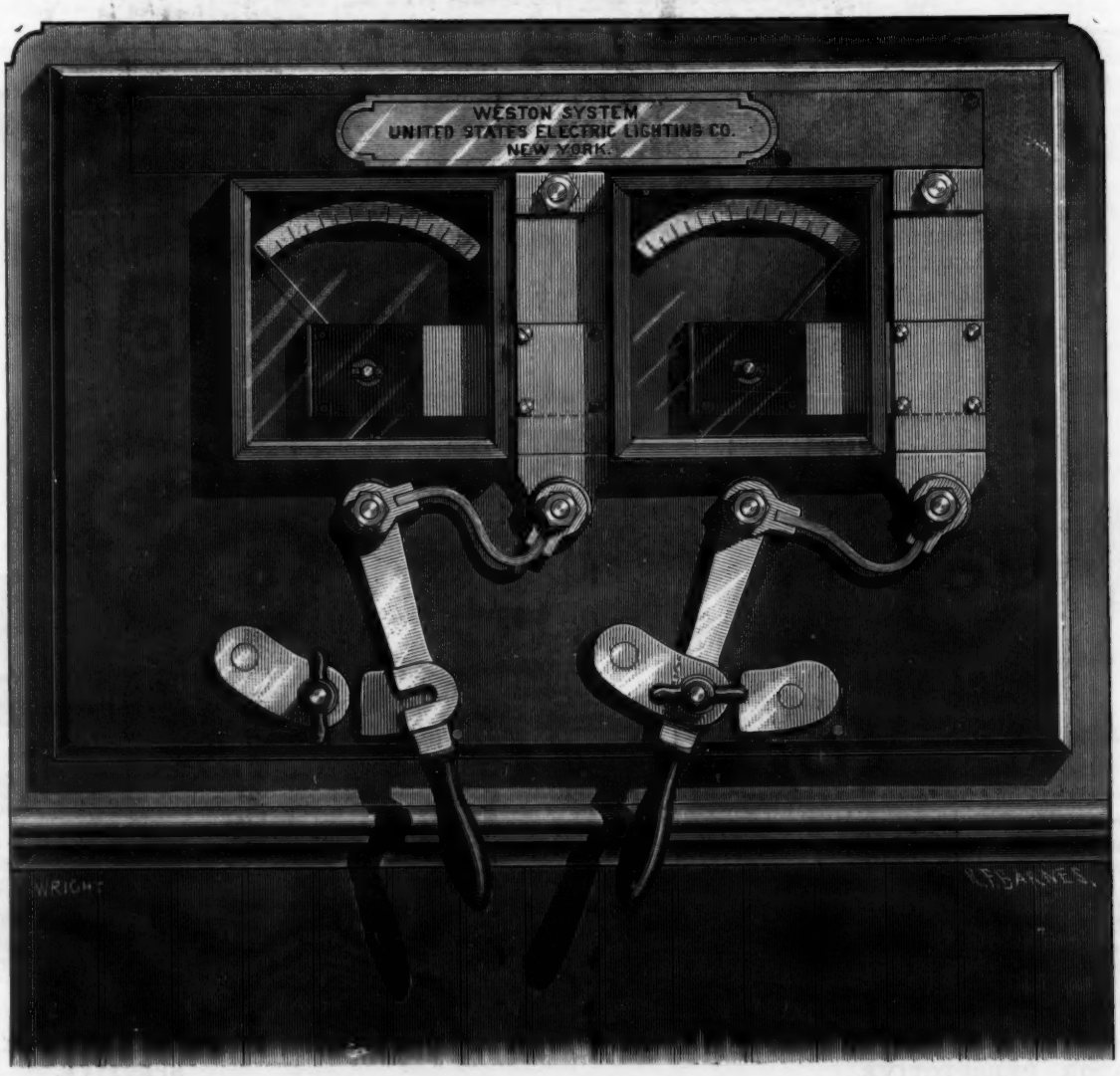


FIG. 7.—WESTON'S CURRENT METERS AND CIRCUIT SWITCHES.

Gas and Electricity.

When the question of lighting the streets of the city of Schenectady, N. Y., by electric lights was agitated, and the City Council, in response to the public demand seemed disposed to award the contract to some responsible party for the lighting, the gas company people requested that they be considered in the matter, taking the ground that their business was to furnish illumination, and if the public preferred to have the streets lighted by electricity instead of gas they were prepared to do so as cheaply as any one could do it. This, comments the Boston *Journal of Commerce*, is a radical departure from the course pursued by gas companies in general, who have considered it their duty to oppose the introduction of electric lighting to the full extent of their powers and in the end get beaten, thus having an opposition company with which to contend, when on the contrary there are no concerns which could so well adopt an electric light equipment as the gas companies, and why not? In general, the gas works have plenty of room which could be utilized for installing an electric plant, the same office and the same officials, as president, treasurer, directors, clerks, and collectors, would serve for both purposes, and, in addition to that, there could be a great saving effected by adapting the boilers to burn, as fuel, the refuse of the gas works, such as coke and the fine coke breeze. If the gas companies would look upon electric lighting as an adjunct to their business, and which could be run at a profit by them, where a separate company, especially for electric business, would be run at a loss; and follow up such views by adopting, in the smaller towns having gas works, some electric system, the results would be far more satisfactory.

The Best Location for Poles and Overhead Wires.

BY D. B. MACQUARRIE.

Several articles in recent issues of THE ELECTRICAL WORLD show that the tide of opinion on the subject of the underground system of running wires is not so favorable for its adoption as the too sanguine projectors of that scheme could wish. The recent convention of electric light men at Baltimore in its discussion on this subject has practically resolved that none of the underground systems now before the country have yet been sufficiently developed to guarantee good service in that particular field of electricity. I can well understand that a system of wires which is laid under ground and left undisturbed perhaps for years can be made to work with satisfaction electrically. But in the telephone and electric light service the numerous changes that have to be made in the line wires from day to day present too many mechanical and electrical difficulties to admit of burying them out of sight or placing them in any position not easy to get at. I think with Professor Sweet, that some plan can be adopted by which the wires can still be left above ground, and all the present objectionable features removed. The Professor's plan of arching the street from a base of support placed on the sidewalk on each side of the street is both feasible and practicable, and is one of the many ways in which this difficulty can be solved. But it seems to me that a double line of posts, even of lattice work, would be crowding the sidewalk too much, and would be rather expensive. Such a structure would have to be made quite strong in order to be able to support the strain and weight of from 200 to 300 wires on the crown of its arch. Neither will it do to adopt any system that will necessitate running telegraph and electric light wires in close proximity to telephone wires for any considerable distance. It is all right for the telegraph and electric light people, but the telephone subscribers must suffer.

I venture to suggest another solution of this problem. Use a pole and cross arm system, as at present, but banish the poles from the sidewalk altogether. Plant the poles in a straight line in the centre of the street, thus dividing the roadway into an *up* and *down* drive, as should be the case on every street. When there is a double track for street car service, plant the poles in the centre between the two tracks. I am well aware that this will be considered an innovation, and a departure from established usages, but a candid consideration of the scheme and a knowledge of the details of telegraph construction work will convince anyone that it is quite practicable, and, in many points, even desirable. The public have so long been accustomed to see the poles on the edge of the sidewalk that they cannot well imagine their being placed elsewhere, but throwing prejudice and precedents to one side, I think the poles would be less in the way in the centre of a street of ordinary width than anywhere else. The only objections that can be urged are bad appearance, narrow streets and the being in the way of foot passengers or vehicles when crossing from one side of the street to the other. Taking these objections in the reverse order, one pole in every 50 or 60 yards would never interfere with the cross-travel or traffic on any particular street. As to narrow streets, they should, as far as possible, be avoided. The telephone wires being sensitive to the inductive influence from other surrounding wires should be given a street by themselves, and the telegraph, electric light and American District wires, which are not affected in their working by the current from each other, should be made to occupy a combination pole, that is, so many cross-arms, pins, or points of contact reserved for each company's wires on one and the same line of poles. This would divide all wires in a large city into two classes. Then, going in any one direction, say north and south, each class of wires could be given every third street, or perhaps farther apart, according to the needs of each service. One line of poles of each class would serve a block or two to the right and left of it.

As to appearances, a line of poles in the centre of a wide street, like Market street, Philadelphia, would be more of an ornament than otherwise. Such a line should be built of the best material to be obtained. The poles should be large, sound, straight and uniform in height. They should be dressed and planed smooth, planted solidly in the ground, and be kept in line and perpendicular. They should be kept carefully painted (a fresh coat every two years). The arms and pins should be of a larger size than usual. The arms should be supported and kept horizontal by braces and have semi-circular guards at each end to prevent any wire coming loose from falling into the street. The wires should be strong, as tight as possible and kept level and uniform on each and every span. I can now recall several streets in some of our largest cities that have their centre so occupied as to prevent any crossing by teams from one side to the other, except at intersecting streets. Notably among these may be mentioned Charles street and Broadway in Baltimore. The centre of these two streets for miles at a stretch is planted with sod, shrubbery and flower beds, dividing the roadway into two drives, an *up* and a *down* road. Again, Spring Garden and Ninth streets, Philadelphia, are so occupied in the centre—one by a series of market stalls and the other by the tracks of the Philadelphia & Reading Railroad Company, thus virtually dividing each of them into two streets. Another instance is Park avenue in New York City.

The advantages to electrical companies from placing their poles in the centre of the street would be many and substantial. Almost every property owner abutting the street claims to control as far out as the centre of the street in front of his premises, and has special jurisdiction over the sidewalk, particularly when he wants to utilize it himself for storing empty dry-goods boxes, crates, and ash barrels. Wherever there is a flag-stone sidewalk, it is generally excavated underneath for coal cellars, and it is rather difficult to get permission to cut through the flagging and occupy the basement for support to the poles. The corners of every street are so occupied with gas posts and man-holes, that it is next to impossible to get permission to plant two poles each opposite the property line, as should be the case to make a good turn. Now, in the centre of the street is a neutral zone, which cannot in justice be claimed by either party abutting the street. The digging there is always good, and nothing interferes. The workmen can always string their wires without being in the way of people on the sidewalk. As the poles are in the centre of the street, the wires can be turned to the right and left at equal distances, to enter a subscriber's residence or place of business.

I would also suggest, in connection with this, that the lamp posts and water plugs to be met with at every street corner could, with equal propriety, be banished to this neutral zone in the centre of the street. The lamp post could be dispensed with altogether. The supply pipe could be taken up in two branches, one on each side of, say, every second pole. A bracket could be attached to the side of the pole from which to hang the lamp, and the pipe carried inside of this lamp.

Such a system of poles, gas, and water service, would be the most convenient and economical for the public, the gas, fire, and water departments; it would present no mechanical or electrical difficulties, and it would not interfere with any private or vested rights of either individuals or corporations.

Hell Gate.—The House of Representatives Committee on Commerce has instructed Representative Johnson, of New York, to report favorably a bill to appropriate $12,000 for the purchase of the leased site on which the Hell Gate Channel (New York) electric light now stands. It will be remembered that the lofty tower there has a crown of powerful Brush lights.

The New Hochhausen Dynamo.

In his excellent work on "Dynamo-Electric Machinery," Prof. Sylvanus P. Thompson makes the following forcible statement: "The ideal dynamo of the future has but one turn of wire to each section. It will have practically no lead at the brushes, will not spark, and its internal resistance will be practically nil." To fulfill all these conditions must evidently exact the highest degree of skill in the proportioning of the various parts of the dynamo, especially when the latter is considered as an object of commerce in which the prime consideration with the purchaser is generally that of cost. Still there can be no doubt as to the truth of Prof. Thompson's remark, and different constructors have sought to approach this ideal in various ways.

So many forms of dynamos have been suggested, that it might be difficult at this time to add to their number without adopting, at least in part, some earlier suggestions. Innovations in the form of dynamos, which would lead to greater efficiency, especially in that of the field magnets, usually bring with them difficulties of construction. It is, therefore, gratifying to note a successful departure from the usual forms, and the more so as the change brings with it an improvement in the economy of the machine. We refer to the new dynamo recently constructed by Mr. Wm. Hochhausen, of the Excelsior Electric Company. While not entirely novel in outward appearance, it embodies a number of interesting features which contribute to the excellence of its performance.

THE NEW HOCHHAUSEN DYNAMO FOR INCANDESCENT LIGHTING.

The machine is shown in perspective in the accompanying illustration. It rests upon an octagonal "box" base, upon which are mounted standards for the armature bearings The field magnets are double curved, forming consequent poles, and the armature revolves in an intense field.

Dynamo makers are gradually drifting into the more general use of wrought iron in the magnet cores, and while Mr. Hochhausen has used this material in the older forms of his machine, its adoption here is made practicable by an ingenious method of construction. It is evident that the forging and final shaping of the cylindrical mass of iron, 4 inches thick, which serves as the core of each magnet, would be very expensive, and mindful of this, Mr. Hochhausen has adopted an ingenious plan in the construction of the cores. For this purpose he employs boiler iron of ¼-inch thickness. Taking a sheet of this material of the width of the magnets and of proper length, he bends it between rolls until it takes the shape of a cylinder equal in diameter to that of the inside diameter of the magnet core. He then takes another sheet and bends it to a diameter such that it will fit tightly over the first one. This process is continued until the required thickness is obtained, resulting in a solid mass of layers of soft iron. Probably no better material than good, soft boiler iron could be obtained as a material for this purpose, and the manner in which it is applied must be admitted to be decidedly novel and ingenious.

The wrought-iron cores are then covered by wire slipped over in sections, there being eight to each core. The cores are brought together so as to touch each other above and below the armature, and at those places they are joined together by diamagnetic material, thus obviating the use of pole-pieces. At the sides, the magnets are supported by the base frame on the neutral line.

In the armature of this machine, also, Mr. Hochhausen has introduced some improvements. It is of the Siemens type of drum armature, the core being built up of alternate layers of tinned wrought iron and paper. The tinned iron is stamped into the proper diameter, and at the centre also a blank is stamped out so as to leave a "key" attached to the disc. A key-way being milled the whole length of the armature shaft, the discs are thus held in place and are pressed tightly together by screw-heads at each end.

The winding of the armature presents several interesting points. In the older forms of Von Hefner-Alteneck winding of the coils, the continual crossing of the wire at the ends causes the formation of a hummock of constantly increasing size, and hence the outer windings contain a greater length of wire than the inner ones. In some cases, this causes an unsteady action and sparking at the commutator. In order to avoid this, Mr. Hochhausen has devised an ingenious plan by which the windings at the end of the armature cross each other without the formation of the usual hump, the ends being perfectly flat, so that the armature presents a symmetrical appearance, and

is completely balanced. It also allows of the armature shaft being shortened several inches.

Another point worthy of notice is the nature of the windings themselves. There is but a single turn of wire to each section, but instead of being a solid wire, the section consists of four smaller wires, whose combined cross-section would be equal to that of a solid one of the necessary thickness. These are not twisted, but laid straight side by side in two pairs. The object of this is to get rid of the internal eddy currents which are generated in heavy solid wires, the bad effects of which were first pointed out by Frölich in 1880.

While to a certain extent the machine is self regulating, external resistances are also employed, which are placed within the box-base and are manipulated by the switch shown in the illustration. A safety strip of fusible metal is also placed in the external circuit to prevent injury to the external leads.

Up to the present Mr. Hochhausen has built two sizes of these machines, the principal measurements of which he gives as follows:

I.

Ampères	75
Volts	100
No. of commutator sections	64
Weight of wire on armature	8 lbs.
Number of convolutions for each coil	1
Armature core	10 inch × 5½ inch diam.
Resistance of armature	0.025 ohm
" field magnets	17.31 "
Length of armature conductor per volt	10 inches
Weight of machine complete	560 lbs.
Revolutions per minute	1,600

II.

Ampères	200
Volts	100
No. of commutator sections	50
Weight of wire on armature	30 lbs.
No. of convolutions for each coil	1
Armature core	18 inches × 8 diam.
Resistance of armature	0.01 ohm
" field magnets	13.25 "
Length of armature conductor per volt	10½ inches
Weight of machine complete	2,400 lbs.
Revolutions per minute	1,200

The machines operate very smoothly, and no sparking is perceptible at the brushes, which have very little lead. A study of the above tables will show that the machines are remarkably well designed, and that the efficiency claimed is a high one.

Responsibility in Telegraphic Transmission of Money.

A case involving principles of interest to those who use the telegraph for the transmission of money to distant points has been decided against the Western Union Telegraph Company, defendant in the action, by Judges Allen and J. F. Daly, in the Court of Common Pleas. The plaintiff, Mr. Van Kohlan, placed $50 with the Western Upion early in the past year for transmission to a person in New Orleans. The money was paid upon demand in New Orleans, but, as was alleged by Van Kohlan, to the wrong person. The case was first tried before Judge Steckler in the Fourth Judicial District Court, in this city. The company claimed to have paid the money to the proper person, but judgment was entered against them upon the grounds of improper identity and because the payment had been made forty-eight hours after its receipt, contrary to the company's printed agreement to return all moneys to the sender not paid within that time. The defendants appealed, but were beaten in the higher court.

An amusing feature of the trial in Common Pleas was the difficulty of securing judges for the tribunal. When it was first reached on the calendar Judges Larremore, Van Hoesen and J. F. Daly were on the bench. Judges Larremore and Van Hoesen announced that they could not serve on the case, as they were stockholders in the telegraph company. Ex-Chief Justice Daly and Judge Allen were substituted when the case came up again, but when the ex-Chief Justice learned the nature of the case he declared that the same reasons which disqualified his brother judges debarred him from presiding. The matter was finally submitted to Judges Allen and J. F. Daly, and the corporation was mulcted in $50 and costs.

Localization of Faults in Electric Lines by Means of the Telephone.

The localization of faults in underground or submarine lines usually requires the services of an experienced electrician, and even with the best methods it is rarely that the fault is located within one per cent. of its true position, so that in an underground cable a mile in length the street or conduit would probably have to be opened for a distance of 50 feet, perhaps, before the fault is found. As the size of the conductor increases and its resistance is reduced, the measurements become more difficult and with the increasing number of heavy underground electric light wires this method would be diffcult of application.

In order, therefore, to locate faults with greater exactness, and also to simplify the methods, M. Eric Gerard makes an ingenious application of the telephone for this purpose, which he describes in *La Lumière Electrique*. He was led to this by the endeavor to find a fault in an electric light cable. To that end he insulated one end of the cable and from the other end sent in a current from a battery, one pole of which was grounded. In the same circuit he placed a vibrator so that the current was intermittent. He then followed along the course of the cable, holding in one hand a coil with a soft iron core placed perpendicular to the cable, and with the other he applied to his ear a telephone connected to the coil. The intermittent currents passing through the cable were distinctly heard in the telephone, but as soon as the fault or ground in the cable was reached, the telephone became silent abruptly. He was thus able to locate and remedy the trouble very quickly.

The apparatus and method employed are such that any one of ordinary intelligence can apply them. For a vibrator or current breaker the ordinary vibrator bell mechanism can be employed.

M. Gerard has studied the best form of coil to be used in connection with the telephone, and finds that the following gives indications in the telephone when at a distance of three yards from the wire: A cylindrical core 40 centimeters long and made up of a bundle of iron wires 0.2 m. in diameter; section of core, 12.56 sq. cm. There are 500 turns of wire on the coil, and the resistance is 0.3 ohms. This coil, nearly 16 inches long, is rather cumbersome, however. Another coil giving indications at a yard, had a core 4 inches long of the same wire, 4.9 sq. cm. in section, and was wound with 500 convolutions having 0.8 ohm resistance,

While evidently applicable to underground and exposed lines, it is also suggested that the methods might be employed with cables crossing rivers and even the deep sea cables by sinking the "detective" coil under water.

A New Incandescent Lamp Switch.

The principal objects to be attained in an incandescent lamp switch are a good contact and rapid make and break,

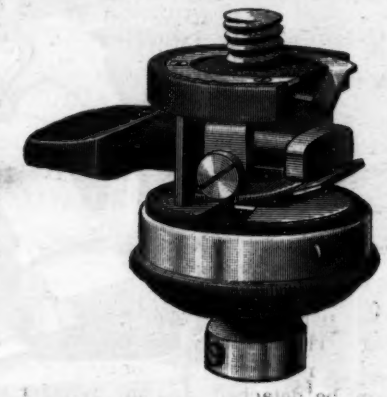


FIG. 1—NEW INCANDESCENT LAMP SWITCH.

so as to avoid sparking. Among the recent switches designed from this standpoint is that of the Consolidated Electric Light Company, of this city. The switch is shown in perspective in Fig. 1, and its action is apparent. The rectangular contact-maker lies flat against the lower spring

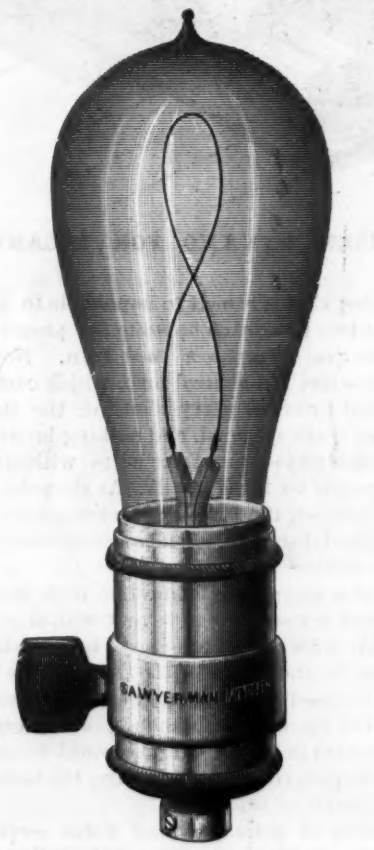


FIG. 2.—SAWYER-MAN LAMP WITH NEW SWITCH.

when the lamp is turned off, but when it is desired to light up, the turning of the switch beyond a certain point causes it to snap quickly so as to make contact with the upper spring. In the same way the turning off is accomplished with a "snap," insuring a rapid break. The lamp bulb with its base is screwed to a solid bearing against the upper contact strip, making a firm contact and preventing a loose joint from being made by a jarring of the parts. Our illustration, Fig. 2, shows the lamp and socket combined.

A Few Telephone Figures.

Before the Massachusetts Legislative Committee on Mercantile Affairs, Mr. F. J. Boynton, the auditor of the New England Telephone Company, laid, last week, some interesting figures. He said that the capital stock was $12,000,000. The number of stockholders who had five shares or less was 300; those holding between six and fifteen shares were 309; those holding between sixteen and fifty were 227. The total expense to the company during the year 1885 was $699,994, which sum did not include the depreciation in property outside of bells. The average cost of maintaining an instrument was $41.72. This included royalties. Poles cost $30 apiece, were put in forty to the mile, and lasted ten years. Cable averaged a cost of 77 cents. It cost about $6,600 per mile to hang it. The cost to New England telephone subscribers per call averaged four cents. The following showing was read for the nine months ending December 31, 1885:

City.	Number of subscribers.	Gross earnings.	Gross expenses.
Holyoke	256	$9,567	$9,696
Lawrence	245	11,346	9,618
Worcester	699	26,272	26,514
Springfield	614	20,303	19,896
Salem	410	15,906	12,474
Gloucester	217	7,706	6,426
Lowell	677	26,664	22,392

The Distribution of Magnetism in Electro-Magnets.

To the Editor of The Electrical World:

SIR: A recent investigation of the distribution of the magnetism in an electro-magnet, by my friend Dr. Holloway, seems to me to present a novel method which may interest your readers.

The electro-magnet examined was of the U form, and was connected in circuit with a buzzer and battery.

On placing a magneto-telephone to the ear, and moving the other end of the telephone along and near the electro-magnets, the note of the buzzer was plainly audible at four points, viz., at each end of the two coils; showing that the magnet was not perfect in its proportion.

The sound in the telephone was, of course, produced by the magnetic induction from the electro-magnets.

It seems to me that this is a good and quite sensitive method of determining whether the iron is properly distributed in an electro-magnet. J. E. PUTNAM.

LA PORTE, Ind.

Can the Efficiency of a Motor be as High as that of a Generator?

To the Editor of The Electrical World:

SIR: In your issue of Feb. 13 is a valuable paper by Mr. Mardey on "The Dynamo as a Generator and as a Motor," which has attracted a good deal of attention, and seems to be understood by careless readers to show that a perfect dynamo when used as a motor has as high an efficiency as when used as a generator. In other words, if such a dynamo under given conditions as to speed, etc., has a generating efficiency of 90 per cent., when used as a motor under the same conditions it should have the same efficiency, and, if it does not, the loss is due to eddy currents produced in the iron of the armature in the latter case. Some readers also understand the paper to show that if the speed and the difference of potential at the terminals of the motor remain constant, the efficiency of the motor will remain constant also, *i. e.*, it will remain at or near 90 per cent.

Now, in fact, the efficiency of the motor used in the experiments is not once stated in the entire paper. The hasty reader would naturally infer, from what preceded, that it was about 90 per cent., *minus* the loss by eddy currents. But on examining the data given in the table, under head of curve *B* (neglecting the variation of 3 per cent. in the speed), we can calculate that in the first test, when a current of 29 ampères was used, the efficiency of the motor was about 26 per cent., and in the last one, when using a current of 125 ampères, about 60 per cent. In the last case the current used is stated to be "much more than that which, as a generator, was considered the full working current," so that 60 per cent. may be considered the *maximum* efficiency of the motor under the given conditions as to speed and E. M. F. The efficiency was, therefore, neither constant nor in the vicinity of 90 per cent. during these experiments, nor was any new way for making them so described, claimed or hinted at. The efficiency of Mr. Mordey's motor is subject to the same conditions and calculated in the same way as others. The important results which he really brings out are of quite another nature: (1) the best method of constructing a motor; (2) a method of automatically obtaining constant speed independently of the load; (3) that the hitherto unexplained losses in motors are due to eddy currents produced in the iron of the armature.

All this is so different from the impression derived from the paper by readers who either do not or cannot study out the real meaning of the investigation described, that it may perhaps be well to draw their attention to the fact and correct erroneous ideas on the subject. F.

NEW YORK CITY.

The Burnham Automatic Self-Oiling Engine.

As the demand for the electric illumination of private dwellings and buildings increases, the requirements of such installations become more and more recognized. Chief among these is naturally the source of power, and as part of this the steam engine is, perhaps, the most important, for upon it depends not only the evenness of the illumination but also its economy. At the recent Novelties Exhibition held in Philadelphia, a fast running engine of compact and neat appearance was employed in driving an Edison dynamo, and it attracted considerable attention on account of its regularity and the excellent provision which it contained for economy and lubrication. The engine referred to is known as the Burnham, and our illustrations show its principal features in its present shape.

They are very interesting. Fig. 1 is a view of the double engine of this type, with the case removed, and in which the cranks are connected to the shaft at an angle of 90 degrees from one another. This avoids any possible dead centre, and gives regularity of motion, without the use of a heavy fly-wheel. As will be seen, a cast plate *A* carries the piston and valve cylinders *B* and *C*, the joints being ground to a perfect surface. The valve is balanced so that the governor is relieved of all work, its function being merely to regulate the position of the valve. This adds considerably to the sensitiveness of the governing mechanism, which thus responds quickly to any change of load.

The governor itself is of a novel construction, and contains a provision for balancing the link which alters the throw of the valve. The necessity of this is obvious, for with the high speeds at which these engines are run—from 350 revolutions in the larger sizes to 600 in the smaller—the effect of unbalanced moving parts would be quite appreciable.

The speeds above indicated also call for continuous and ample lubrication, and this has been applied to the engine in a very ingenious manner. As will be seen in Fig. 2, the upper face of the slide-head *D'* is formed with a vertical annular flange *g*, which is covered by a plate *g'*, thus forming a shallow chamber, which is filled with wool, cotton waste, or other absorbent material.

Small holes drilled through the cross-head slides allow of the passage of oil to the guides. An oil tank *K* is located on the lower flange of the steam cylinder, and has extending from its bottom a pipe *k*, which terminates just over an aperture in the cover-plate *g'* on the slide-head. The pipe *k* is filled with wicking, so that the lubricating material is delivered drop by drop into the aperture. The fibrous material in the chamber on top of the slide-head becomes saturated, and the oil is fed little by little through the cross-head slides, thus thoroughly lubricating the bearing of the slide-head in the guide. A pipe *l*, communicating with the oil-chamber on the top of the slide-head, extends through the head and projects below it, as clearly shown in Fig. 2. This pipe also contains a wick, the projecting end of which is in proper relation to the cup-shaped mouth of a tube *m*, which leads to the bearing of the connecting-rod pin *f*. As the connecting-rod oscillates, therefore, the oil is scraped from the end of the wick drop by drop, and the bearing kept constantly lubricated. The crank-pin or connection of the connecting-rod *F* with the main shaft is lubricated in a similar manner by oil from a tank *N*, from which a tube containing a wick depends in such relation to the sharp-edged mouth of a tube *O*, carried by the connecting-rod and leading to the crank-pin bearing, that the oil is shaved from the end of the wick drop by drop upon each revolution of the crank.

The main shaft bearings are also provided with oil tanks, and a special device prevents the escape of oil to the outside, it being drained into a channel in the base of the machine.

The engine, which is the invention of Mr. Nathan F. Burnham, is manufactured by the Christiana Machine Works, of Christiana, Pa., the general offices of which are at York, Pa.

The single engine in its inclosing case is shown in Fig. 3, and does not differ in construction from the one just described. The double engine, indeed, is so constructed that in a few minutes either connecting-rod or eccentric-strap can be detached, and one cylinder used, giving the power of a single cylinder engine of the same diameter and stroke. These engines are built in sizes ranging from 2½ horse-power running at 600 revolutions per minute, to 50 horse-power at 320 revolutions, thus adapting them to a large range of work in connection with electric lighting.

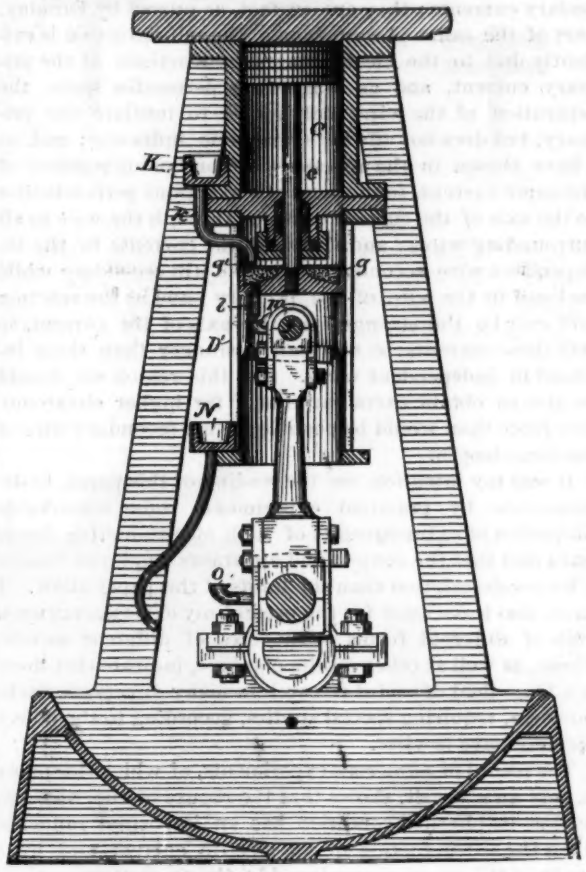


FIG. 2.—THE BURNHAM ENGINE.

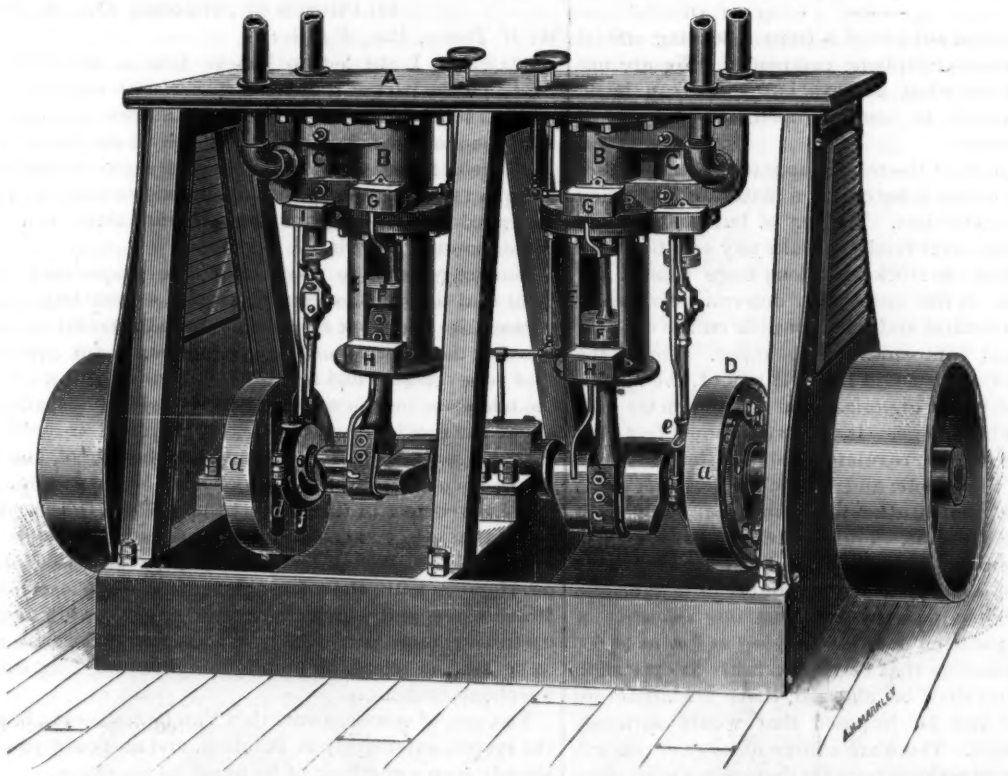


FIG. 1.

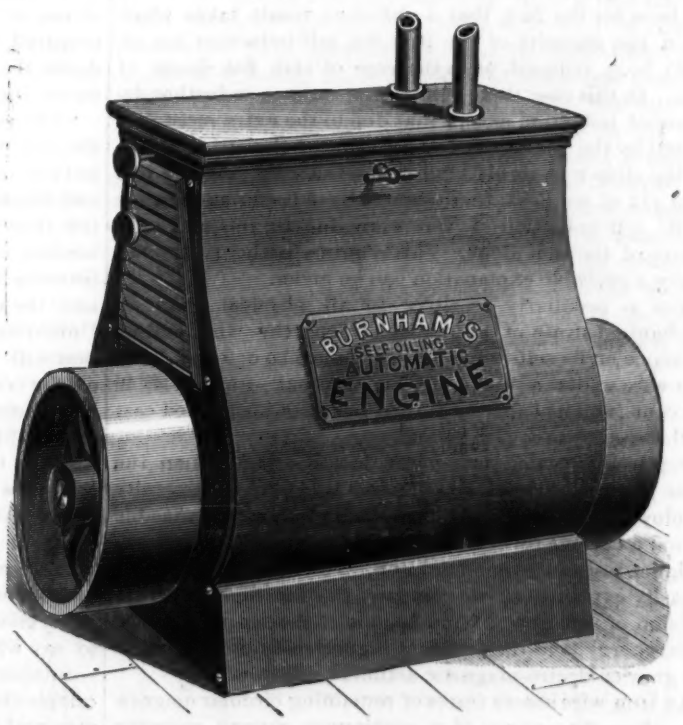


FIG. 3.

THE BURNHAM AUTOMATIC SELF-OILING ENGINE.

Incandescent Lamps for Lighthouses.

In a recent communication to the French Academy of Sciences, M. Felix Lucas, in treating of the illumination for lighthouses, pointed out various objections to the use of the powerful arc-light for that purpose, and expressed himself as in favor of the incandescent lamp.

"The conditions which I have imposed upon myself, by reason of the very nature of the object sought, are the following: 1. The luminous focus must present the form of a surface of rotation having a vertical axis, for the light must be equally distributed in all azimuths. 2. We must have recourse to currents of quantity, and to an incandescent body of low resistance, obtaining many watts with few volts, so as to give power to the luminous focus without producing at the same time a lightning-like, or even dangerous tension. 3. The incandescent body can only be of carbon, because it is the only substance which can support excessive temperatures without fusion or volatilization.

"In a memoir inserted in the *Comptes Rendus* of June 8th, 1885, I made known the law which links the luminous intensities to those of the currents traversing an incandescent carbon. We may obtain 400 carcels with a current of 170 ampères and a resistance (of the incandescent body) of 0.04 ohm, or, in other terms, with a tension of 7 volts and an energy of 1,200 watts. In these conditions the luminous unit does not require, for the incandescent part of the circuit, a mechanical work greater than what it requires at present with the use of the voltaic arc. I have estimated the temperature of the luminous carbon at about 4,000° C., and I have found that the carbon is neither melted nor volatilized.

"We know that in incandescent lamps there is produced in course of time a carbonaceous deposit upon the inner surface of the glass globe. This gradual decrease of transparence would be especially injurious for powerful incandescent foci. I have endeavored to determine the true cause, and my experiments prove that it consists in the presence of molecules of oxygen within the lamp. We find, in fact, that the rate of increase of the deposit is in direct relation with the pressure of the internal gas. We should arrive at an infinite slowness, or, in other words, at the cessation of the deposit, if we could obtain and preserve an absolute vacuum within the glass globe. A molecule of oxygen, not removed, combines with the carbon near its junction with the metallic conductor, a region in which the temperature cannot reach the melting point of the conductor. There is thus formed a molecule of carbonic oxide. This molecule, then, coming in contact with the incandescent portion, the temperature of which is high enough to produce dissociation, projects the carbon against the inner surface of the glass globe and leaves the oxygen at liberty to combine again.

"The realization of an absolute vacuum in an incandescent lamp is rendered particularly difficult by the tenacity with which carbons and metals retain the gases which they have stored up in their pores. Under the influence of the rise of temperature caused by the passage of the electric current these gases escape at first to a great extent, but the liberation soon becomes so slow that we seem in presence of a phenomenon obeying an asympotic loss. This loss, which I have clearly established, shows that every apparatus intended to produce the incandescent light on a large scale must be furnished with an absorber capable of constantly storing up, at every point of time in the working of the lamp, the gases which escape in slight quantities from the heated carbons and metals.

It must be remarked, on the other hand, that the gases liberated during the passage of the current and not removed from the apparatus are reabsorbed by the carbons when they become cold. In consequence, the presence of a small quantity of gas in an incandescent lamp compels the carbons to periodic disengagements and re-absorptions. Hence a mechanical work is imposed on its molecules, which is one of the principal causes of the destruction, sooner or later, of the lamp. To give a powerful incandescent lamp the conditions requisite for lasting, it must be freed from the dangerous influence of even the most rarified gases. I have found that this difficulty may be overcome by the use of absorbent appliances."

The Self-Induction of an Electric Current in Relation to the Nature and Form of Its Conductor.

BY PROF. D. E. HUGHES, F. R. S.

(*Concluded.*)

I have shown a difference of resistance in the variable period between copper and iron of at least 200 per cent.—a difference which will be felt on instruments depending upon rapid changes, such as the telephone; and it is evident that the more rapid the contacts of a telegraph instrument, the greater will be the difference between copper and iron. There is consequently a great electrical advantage in those instruments which require only a single current for each letter, as the economy of electrical impulses allows them to work at a comparatively high speed; the duration of the extra currents would be shorter than the length of their contacts, and consequently they would perceive very little, if any, difference between the two periods, or between iron and copper. If we use three or five currents for each letter, we must necessarily send them faster or closer together; and the difficulty increases in a rapid ratio with the speed of intermittent or reversed currents, until a point is reached (as I have shown in the case of best charcoal iron) where, while nominally working through 500 miles, we are practically working through an equivalent resistance of at least 1,500 miles, and this without taking into account the static charge, which would, in addition, from its comparatively extreme slowness of charge and discharge, cause the apparent resistance of the wire in the variable period to be much greater than I have mentioned.

In Mr. Preece's experiments he finds a difference of speed of 12.9 per cent. between iron and copper, which is far less than the difference of resistance during the variable period which I have obtained; and this may be explained by assuming that the speed of the reversed currents which he employed was only near the border land of extra currents. I am convinced that if Mr. Preece could have increased the speed of the instruments he would have found a far greater difference between iron and copper; and if I regard the results of a solid iron wire alone, I should consider iron as unsuitable for telegraph instruments requiring extremely rapid currents. Copper would reign supreme if it were not for the fact, which I have discovered, that stranded iron wires have even a greater rapidity of action than copper.

PHYSICAL CHANGES IN THE CONDUCTOR.

Self-induction not only depends on the nature and form of its conductor, but also on the physical state of the metal, as already shown in the case of soft and hard iron. I felt convinced that the higher force in iron was due to its magnetic capacity, and to prove this I tried the effect of heating the wire to a bright red heat. It is well known that iron loses its magnetic properties at bright red heat, and I found that its self-induction then fell to less than that of copper. This would have been conclusive had it not been for the fact that a different result takes place when the capacity of the iron for self-induction has already been reduced, as in the case of thin flat sheets of iron. In this case there is no disappearance or further decrease of induction except that due to the extra resistance caused by the increased temperature of the strip. Now, as the strip was highly magnetic when cold, and lost this property at red heat, there should have been some change in its self-induction if this were due to the magnetic nature of the iron alone. This requires further researches before a probable explanation can be given.

Iron is peculiarly sensitive to all physical changes. Mechanical strain of all kinds hardens the wire, and its influence on its self-induction can at once be detected. An iron wire under a moderate longitudinal strain loses 40 per cent, and its capacity is then less than unstrained cast steel.

Iron well annealed has much less resistance than the same iron when hard drawn, and soft iron is generally employed for telegraph lines; but during the variable period a curious reversal takes place, as then soft iron has a higher resistance than hard iron. This apparent anomaly is easily explained if we compare the far higher self-induction of soft iron. Work is done at the expense of electrical energy, and the apparent higher resistance is due to the greater electro-magnetic action in soft iron.

An iron wire shows traces of remaining circular magnetism after the passage of a continuous current, reducing the following extra currents 10 per cent.

Magnetizing the wire, or subjecting it to mechanical vibrations, when used separately, produce no apparent change in its inductive capacity, but a remarkable change takes place if either of these is used in conjunction with a constant current. Let us pass a constant current and heat the wire to red heat, allowing it to cool with the current on; or, in place of heat, magnetize the wire; or, in place of magnetism, give the wire mechanical vibrations: the result of either of these being a strong internal circular magnetism, due, I believe, to the loosening of the magnetic molecules, allowing them to rotate with greater freedom under the influence of heat, mechanical vibrations, or magnetism. A wire thus treated has no longer its previous self-induction, which has fallen 60 per cent.; and as the circular magnetism becomes fixed when the vibrations cease, this molecular structure remains a constant as long as we employ intermittent currents in the same direction, but the structure disappears the instant a reverse current is sent; and this explains why we have more than double the amount of self-induction from reverse currents, as each reversal destroys any remaining magnetism due to the previous passage of the current.

If we compare the electromotive force of self-induction on a given length of wire with the secondary currents generated in a second but independent circuit, we find that the self-induction is the most powerful, the secondary currents generated in a close independent copper wire being 20 per cent. less than its own wire. There is no difference between the self-induction of a current and the secondary currents; they are, in fact, as proved by Faraday, part of the same phenomenon. The self-induction is evidently due to the electro-magnetic reactions of the primary current, and as magnetism permeates space, the separation of the wires only serves to insulate the primary, but does not affect its magnetic influence; and, as I have shown in the reactions of contiguous portions of the same current, so the magnetic reactions perpendicular to the axis of the current continue through the wire to all surrounding wires; and if we call the currents in the independent wire secondary, they are still secondary while inclosed in the wire of the primary; and as the reaction will ever be the strongest in the axis of the current, so will these currents be necessarily stronger than those induced in independent wires. For this reason we should be able to obtain extra currents of far higher electromotive force than would be possible from a secondary wire of the same length.

It was my intention, on the reading of this paper, to demonstrate by practical experiments some remarkable properties of extra-currents of high electro-motive force, but I find that the subject and apparatus employed require a longer description than the limits of this paper allow. I must also leave aside for the present my experiments upon coils of different forms with cores of different metals. These, as well as other results obtained, indicate that there is a large field of useful research in many directions, each, however, requiring special studies, according to the object we may have in view.

The record of numerous experiments, of which this paper is only an abstract, shows that the nature of the metal as well as its physical condition has an important influence upon the self-induction of an electric current, and by a study of the reactions produced by the contiguous portions of a current, and by application of the results, we may, as in the case of iron, transform an extremely slow conductor into one of the greatest rapidity; I therefore hope not only that these researches may be of interest from a scientific point of view, but that the results obtained may be of practical utility in some of the numerous applications of electricity.

The Management of Telephone Companies.

The communication subjoined is from a leading official of one of the western telephone companies. We are not prepared to indorse what he says, but there can be no doubt that the points he touches upon are vital and of increasing importance:

"The present state of the telephone interests in the Middle and Western States is becoming a matter of increasing anxiety to the stockholders. The day of bubble dividends and bleating sheep—ever ready to make any sacrifice for a few shares of telephone stock—has long since passed, and we find ourselves at the onset of a determined struggle between the legislatures and city councils on the one side and the telephone companies on the other. Should the United Supreme Court sustain the Bell patent, the opposition will become better organized and the character only of the conflict will change. It is a well-known fact that cities possess the right to regulate on all matters affecting the condition of the streets, and if such right is not given them by the State Constitution it becomes but a matter of time in which to obtain it. I do not know what the experience has been east of Cleveland, O., but I do know that eastern men express surprise at the number of instances in which we are called upon to fight the one question of underground legislation in cities ranging as low as 50,000 population. Conceding that no city or State has the right to say what rental shall be charged, there are numerous regulations that can be imposed that would seriously cripple the business. There are a large number of councilmen and legislators seeking to cover themselves with glory by opposing corporations, and they spend a large portion of time inventing adverse legislation.

"Are we prepared to deal with this question?

"The manner in which the companies are controlled certainly proves a hindrance to effective and decisive action. The major part of the companies have a board of directors composed of from five to eleven stockholders, and from this board the executive board, usually three in number, is elected, they having power to act in the absence of the "regular board." All important matters must either be decided upon at once or left until these boards are in session. The majority of directors are bankers and business men whose ideas on numerous matters are conflicting. In many instances one company will act entirely the reverse of another in a matter in which the circumstances and conditions are similar, such action being prejudicial to good government. It is well known that the most successful corporations are those under the control of an individual. The whole panorama of events passes before him, and by devoting all his energies and time in one direction, it follows as a matter of course that he is better able to govern.

"In the next ten years the country lying west of the Mississippi will be dotted here and there by towns that have no existence at present, while the population of others will become less. East of Chicago the cities and towns will perhaps increase or remain at a standstill. It is in the West that the highest ability is now and will always be required. There should be a man placed at the head of such companies who is able to cope with all the questions (peculiar to the business) which arise, a man that is highly capable, and who will command the esteem and confidence of the stockholders. I believe a careful and conscientious investigation of the situation will satisfy any one as to the expediency of a change in the governing power, which will be as satisfactory to the parent company as it will be to the stockholders."

The Goodsell Suit Against the Western Union.

The Atlantic and Pacific Telegraph Company, in the early part of 1884, contracted with Charles Goodsell for the transmission of news dispatches. Mr. Goodsell agreed to pay $60,000 per year for a certain number of words, and the contract was to last for ten years. When the Atlantic and Pacific Telegraph Company was amalgamated with the Western Union the latter assumed the contract and carried it on for several months. Then Mr. Goodsell was notified that there would be an increase in his rates. He declined to accept the new terms and the contract was broken. At the time there was due him on collections the sum of $16,000. He brought suit in the Superior Court against the company and recovered that amount, with $220,000 damages besides for breach of contract. The case was appealed to the General Term, and that tribunal affirmed the judgment of $16,000 with interest. The opinion handed down admitted that the Western Union was liable for damages, but directed that the amount of damage due be reassessed by a jury. The judgment was entered on March 4, and an execution for the $16,000 was issued on the 9th. A sheriff's deputy, on March 17, made a levy on $15,000 which the cashier of the Western Union was preparing for deposit in a bank. Five minutes previous, however, the County Clerk had been served with a bond of appeal to the Court of Appeals, which caused a stay of all proceedings. The sheriff's deputy went away empty-handed, and Mr. Goodsell has not yet obtained satisfaction of his claim.

Simultaneous Telegraphy and Telephony.

The following interesting correspondence, forwarded to us for publication, is self-explanatory:

121 CHURCH ST., TORONTO, Nov. 23, 1885.

W. H Preece, Esq., F.R.S.:

DEAR SIR: I am led to believe that a misconception exists, on the part of some in America with regard to your position on the question of the simultaneous transmission of telephonic and telegraphic messages on the same wires; and I write to ask you if you will kindly give me authority to correct said misconception, if your views have been misunderstood, or if they have been modified since you were in this country in 1884.

You are reported to have made the unqualified statement that the simultaneous transmission was impractical, because the telephone equipment caused retardation in the speed of the telegraphic signals. Now, I am persuaded that your remarks had reference to your experiments with the telephone on the wires of the post-office department, where the rapid automatic telegraph system is used, and that said remarks had no reference to the use of the telephone in connection with the ordinary Morse system.

If I am correct in this conjecture, will you please write me to that effect, so that no injustice may be done to a system which, we find, causes neither retardation of, nor interference with, the telegraph signals, when used on the Morse wires, and which appears to have a wide field of usefulness, more particularly in permitting telegraph wires to be used as telephone trunk lines for connecting distant telephone exchanges.

You are, of course, aware that Van Rysselberghe is using the system extensively in Belgium, and no doubt you have already seen something of its practical operation.

Awaiting an early reply, I am, Yours truly,

A. M. ROSEBRUGH.

POST OFFICE, London, Dec. 15, 1885.

DEAR SIR: I have to thank you for your letter of Nov. 23, with reference to the Van Rysselberghe system of Telephones *cum* Telegraphs.

My opinion had reference to Wheatstone automatic working only.* Yours faithfully,

A. M. ROSEBRUGH, M. D., 121 Church St., Toronto. W. H. PREECE.

*With the Wheatstone automatic system, here referred to, very rapid alternating currents are used, and with a single electro-magnet (the receiver) in circuit. The addition of a second electro-magnet causes retardation of the current, which is practically a telephone current with about 5,000 vibrations per minute; hence the addition of the electro-magnets of the telephone system becomes inadmissable. With the Morse system, as is well known, the case is very different. The addition of an electro-magnet of, say 150 ohms, at each end of the line, does not cause the least retardation of the telegraph signals. Indeed, the telephonic equipment so completely suppresses induction that the working capacity of parallel wires is improved, as well as the wire or wires so equipped.

A New Universal Engine Lathe.

In the electrical laboratory and workshop, a good lathe may take the place of many special tools, and the constant and varied experiments undertaken in such places make universal and accurate tools of this character a great desideratum. Recently the Waterhouse Electric and Manufacturing Company, of Hartford, Conn., bearing this in mind, have brought out a "universal" engine lathe which embodies a number of interesting and valuable features. As will be seen in our illustration, Fig. 1, the design of the lathe differs from that of the ordinary engine lathes, in that the centres are not over the centre of the bed. This enables the carriage and slide rest to be moved past the head and tail stock without coming in contact with them; and being on the side of the lathe, it permits of the cutting of short work up to the centres. The placing of the slide-rest on the side of the bed also allows of a direct vertical adjustment of 2 inches (graduated) so that the cutting tool can be raised or lowered without readjustment; or a milling vise can replace the top slide and the cutter run in the spindle of the lathe. The slide-rest is otherwise very complete, having a large graduated base for cutting at any angle, and the cross and angular feed-screws have micrometer heads reading to thousandths of an inch, which can be used in place of the caliper to turn work to size.

The lathe is provided with two leading screws. The upper one is a fine precision screw, cut under the microscope by a patented process owned by the company. By having as a second a good ordinary leading screw, this precision screw will retain its accuracy. Both of the leading screws, the feed screws of the slide rest and the spindle of the head, have an arrangement to take up the wear when it shall occur. The head spindle, as shown in Fig. 2, is hollow, made of steel, and with the boxes is hardened and ground accurately to bearing. By the use of two translating gears the metric thread can be cut from the same set of change gears as the English thread.

The lathe evidently marks a decided advance on older forms and will no doubt fill the wants of numerous electrical manufacturers as well as experimenters.

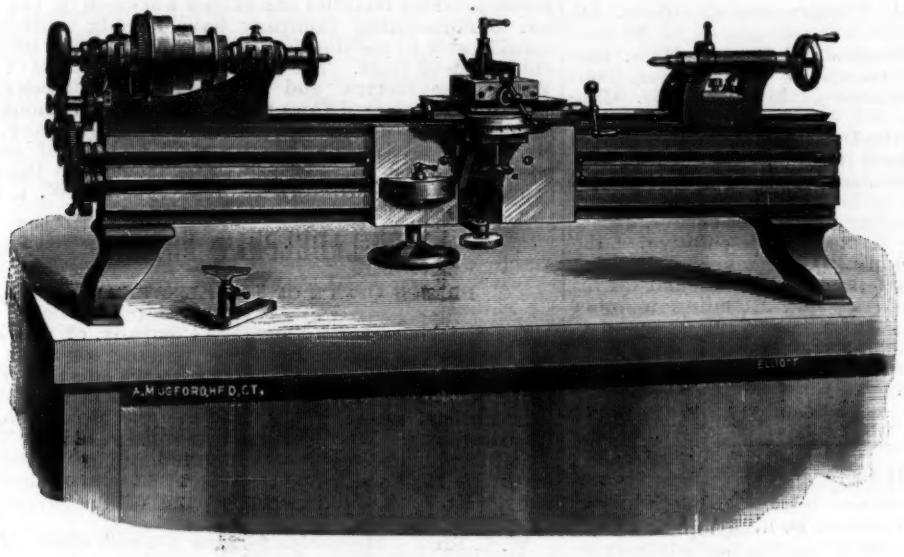


FIG. 1.—NEW ENGINE LATHE.

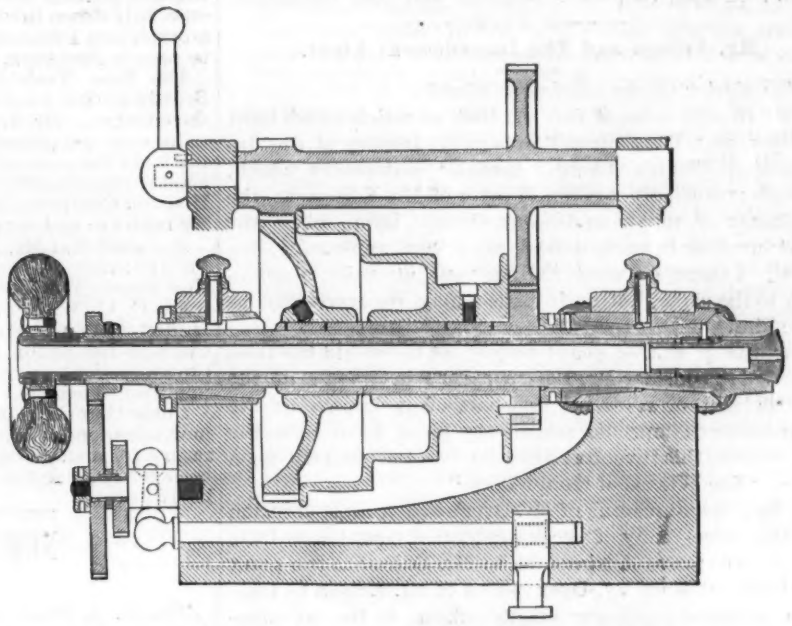


FIG. 2.—SECTION OF BACK GEARED HEAD.

A Handy Electric Gauge.

A new electric gauge of convenient size, which has lately been put upon the market, is about the size of an "Ameri-

HANDY ELECTRIC GAUGE.

can" watch, and is intended for testing the current of single cells of battery. It is worth the attention of telephone inspectors or any one using electric batteries, as the condition of each cell may be known by simply connecting the terminals of the gauge to it, which saves much time and annoyance. Many cells are laid aside daily which would do much more good service and soon pay for the gauge. Its action is quite different from that of the galvanometer, as it gives equal divisions of the current. The pointer comes to rest instantly, and it is not affected by outside influences. A larger size is also made for the battery room or office use, and has a much larger range, so that it can be used on battery lines as a fixture to show at all times the rise and fall of the current. Any further information will be furnished by the inventor and patentee, C. D. Warner, Ansonia, Conn.

A Novel Wire Cleat.

Where the wiring in buildings is not inclosed in molding strips, its firm attachment to the walls is of prime importance. It is also well to make the points of attachment of as high resistance as possible. A simple and efficient cleat for this purpose has recently been devised by Messrs. Hoggson & Co., of Bridgeport, Conn. It consists in a disc of gelatinized fibre, as shown in Fig. 1. These discs have two creases on their under sides parallel with each other, in which the wires are laid, and the cleat is fastened down tight by means of a screw or wire nail. In damp places where it is necessary to use extra precautions, two cleats may be used, placed with the creased sides together, thereby preventing the wires from coming in contact with the wall. The cuts show the full size of a cleat, which holds wire from No. 14 to No. 22.

FIG. 1. FIG. 2. FIG. 3.

NOVEL WIRE CLEAT.

The Electrolytic Cartridge.

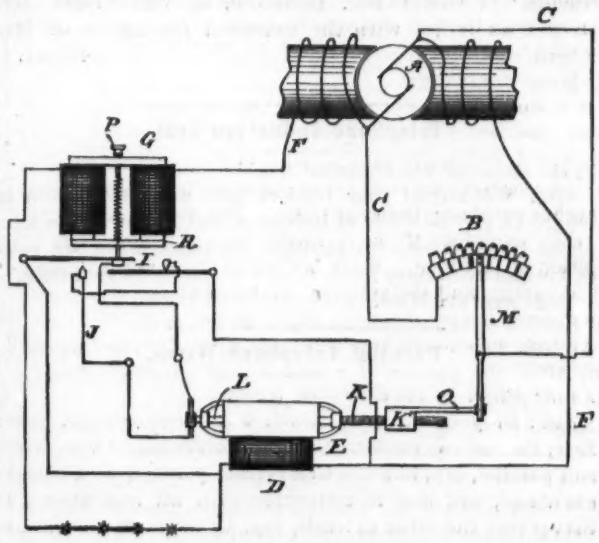
It is stated that this new form of the cartridge consists essentially of a glass tube of a diameter to fit easily into the borehole, which should be small. The tube is very strong, the thickness of its walls being about equal to the diameter of the bore. Two wires are fused into this tube, which is hermetically closed after being nearly filled with water rendered conductive with a little acid or some metallic salt. When this cartridge has been inserted into the borehole, and the latter tamped or stemmed in the usual way, its projecting wires are connected with cables serving as "leads" from a source of electricity. All being ready, the current is put on, and the current from the generator passes between the ends of the wires within the glass tube and decomposes the water. The explosive mixture continues to accumulate as the decomposing action of the current goes on. It is to withstand the increasing pressure of the liberated gases that the thick glass is required. So long as the ends of the wires are covered by the liquid, no spark can be produced to ignite the gaseous mixture; but when these—or one of them—are laid bare by the conversion of the water into gas, the current has to pass through the latter, which is then fired. The resulting explosion is extremely violent—more violent than that of nitro-glycerine even.

Bleaching by Electricity.

The idea of bleaching by electricity is by no means new, indeed the early discovery of ozone generated by electrical means and the well-known powerful bleaching property of the same obviously at once suggested the possibility of an electrical process for bleaching coming into use. Several years ago the electrical bleaching of sugar was, we believe, says the London *Electrical Review*, carried on by a firm of refiners in Lambeth, the electricity for the purpose being generated by a Wilde machine. Whether the system is still in operation we are unable to say, but the fact that practically-nothing has been written or published on the general subject would seem to indicate that bleaching by electricity has not been really practicable. Recently the subject has been again taken up, and this time with good prospects of success; this is owing to a discovery of M. Hermite with reference to a chemical reaction which takes place when the chlorides of the alkaline earths, and notably chloride of magnesium, are submitted to electrolysis. The chlorine in the substance under the action of the electric current has a powerful bleaching action, though, curiously enough, no waste of the substance takes place, the chloride becoming, it is stated, regenerated automatically. Thus if indigo be in solution with the chloride bath and platinum electrodes be employed, the color becomes discharged by the action of the electric current without any sensible disengagement of chlorine. The principle has been practically applied for the bleaching of cotton goods and, we are informed, with excellent results, the fibres being far less injured by the new process than is the case under the ordinary method; this is due to the action being completely under control.

A Regulator for Dynamo-Electric Machines.

The regulator of the dynamo occupies relatively the same position as does the safety-valve on the steam boiler, and in addition it partakes of the nature of the cut-off on the steam-engine. In the one case it prevents the generation of too great a current and on the other hand it regulates the quantity to the demand. Many devices and methods of regulation have been devised to combine these functions. One of the more recent of these is that due to Messrs. Osborn P. Loomis and Henry W. Cooley, of Lynn, Mass. They have adopted a method of regulation that consists in throwing more or less resistance into a shunt around the armature of the dynamo. The mechanism employed for varying this resistance is shown in the accompanying illustration. It consists of a motor *D* and a solenoid *G*, both located in the circuit of the dynamo as shown, the former serving to operate the variable resistance. There is also a pole changer employed. When the main circuit current becomes weak, the armature of the solenoid is lowered, thus reversing the current through the motor by means of the rheotrope or pole-changer, *I*, which operates in the well-known way. When the motor reverses it introduces more resistance into the shunt around the armature of the dynamo. Consequently an additional current is forced through the main circuit until it attains again its usual strength. The reversal of the motor is regulated as to the time and amount of current by the screw shown at *P*, which raises or lowers the armature of the solenoid.



NEW DYNAMO REGULATOR.

When the current becomes too strong, the reverse operation takes place, the pole-changer then passing a current through the motor so as to make it revolve in the opposite direction and cutting out resistances until the current is again brought to its normal strength.

Promotion of Scientific Knowledge.

Many of our readers will be aware that the King of the Belgians founded some time ago an annual prize of 25,000 francs ($5,000) for the promotion of scientific knowledge. This sum, which represents the third international prize competition, will be granted in the year 1889 for the best work on the progress of electricity as a motive power and for the purposes of illumination, or the various forms in which electricity is used or might be made use of, and on the economical advantages which the application of electricity appears destined to afford. Foreigners who desire to participate in this competition must send their essay, printed or in manuscript, before January 1, 1889, to the Minister for Agriculture, Industry, and Public Works in Brussels. A new edition of an already printed work will only be admitted to the competition when the same has undergone considerable modifications and been greatly enlarged, and provided the same shall have been issued, like the other works submitted, within the years 1885, 1886, 1887, or 1888. The essays may be written in any one of the following languages: German, French, Flemish, English, Italian, and Spanish. The King of the Belgians will elect a jury as judges for awarding the prizes, composed of seven members, viz., three Belgians and four foreigners.

Mr. Edison and The Incandescent Light.

To the Editor of the Electrical World:

SIR: In your issue of Feb. 27, 1886, an article by Richard N. Dyer, on "The Salient Points in the History of the Incandescent Electric Lamp," contains statements which, though professedly written in favor of Mr. Edison as the originator of the incandescent electric lamp, place the great inventor in an equivocal, not to say unpleasant, position. I therefore write, calling your attention particularly to the same, lest an injustice may inadvertently be done him.

For the past five years nearly all the world has been educated to consider Mr. Edison as the originator of the electric light, or at least of that part of it known as the incandescent lamp. So manifestly great have been the resources of this inventor, that he has not inaptly been styled "The Wizard of Menlo Park."

Even a casual reading of Mr. Dyer's article must occasion surprise, since many of the statements it contains as facts cannot but prove detrimental to Mr. Edison as the great inventor. If what Mr. Dyer asserts of Mr. Edison be true, then the latter gentleman's contributions to the incandescent electric lamps of to-day contain but little that is new or startling.

According to Mr. Dyer, Mr. Edison's lamp differs from all that have preceded it mainly in two important respects, viz.: 1st. In the fact that its incandescent conductor is filamental, and consequently of high resistance; and, 2d. In that Mr. Edison's lamp is what Mr. Dyer calls a "structural unity"—that is, a lamp whose inclosing chamber is made wholly of glass; and, containing no provision for the reintroduction of another filament on the destruction of its first, must, then, necessarily be thrown away as useless.

Here indeed is "a pretty state of things." Mr. Edison's recent labors for the public weal in the domain of electric lighting limited to such narrow claims, and this too when the Edison Company is extensively advertising, "the incandescent electric lamp is the universally acknowledged invention of Thomas Alva Edison, etc." If the article be inspired in a truly friendly spirit toward the great inventor, Mr. Edison may well exclaim, "Save me from my friends." I would ask, therefore, by what right Mr. Dyer thus trifles with the extended reputation of Mr. Edison? LIGHT.

NEW YORK CITY.

Telephone Induction Coil.

To the Editor of The Electrical World:

SIR: Will any of your readers give me information in regard to the best size of induction coil to use with a telephone transmitter with multiple contacts, using six cells of Leclanché battery? SUBSCRIBER.

DORCHESTER, Mass.

Parallel Telephone Wires.

To the Editor of the Electrical World:

SIR: In your issue of March 6 a correspondent from Erie, Pa., asks an explanation of the following: "Two wires run parallel, say, 15 miles to a certain point, from a certain exchange, and one is connected with an instrument at that point; the other extends, say, 15 miles further to another instrument. The subscriber at the point 15 miles distant wishes to talk to the subscriber 30 miles distant, and calls the central, and is connected through the exchange. It is with difficulty that the conversation is carried on. In fact, by grounding both lines in the central, better results are obtained by induction. Either line on a direct wire would work, say, 90 miles."

In answer to this, I would say that I long ago observed the same thing and attribute it to the mutual repulsion between two opposite currents; though leakage from one line to the other might have something of the same effect. The only remedy for the "trouble," of which I know, is to run the longer line into the station at the end of the short line, and through a common flat spring-jack. Then by using a flat plug, this station can "cut in" and talk directly with the other. By using a double plug and connecting by double cord to instrument, the central office can still supervise the business over the line. This arrangement will be found convenient on other accounts, easily seen by a practical man. MANAGER.

EAU CLAIRE, Wis.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, March 22, 1886.

It is a notable and significant fact that the leading electric light stocks are in much brisker demand at present than they have been for some time past. Recently, as was noted in THE ELECTRICAL WORLD, there have been inquiries for Edison stock at advancing rates; and last week I had a personal inquiry in regard to Brush stock that was wanted as an investment. I am not particularly concerned as to whether any very large sales have been or can be made. Some of these stocks are very firmly held, but there is no gainsaying the fact that the demand exists and is lively.

I have it on good authority that parties East are negotiating for the control of the Fithian engine. It was described in the WORLD in March, 1885.

The Electric Time Company, 146 Broadway, are actively engaged putting in clocks in various parts of this city, especially down town. I see the clocks well distributed around, and I understand that a good many are already to be seen in Brooklyn.

The New York Electric Construction Company, 145 Broadway, are busy wiring for the electric light all over the country. Mr. J. H. Hapgood, of Detroit, Mich., said some very complimentary things to me last week about the work the company had done in his city. Mr. Hapgood is prominently connected with the Detroit Thomson-Houston Company, using the Dorsett underground system for both arc and incandescent lighting.

It is said that Mr. Dorsett has an order from Brooklyn for five miles of conduit in behalf of the New York & New Jersey Telephone Company and other parties.

Mr. C. C. Warren, the Western representative of the United States Electric Lighting Company is here from Chicago for about a week preparing a circular for his growing clientage in the West, and attending to other important business.

I hear that some individuals are anxiously looking for a new telephone, the inventor of which received $20,000 in return for a stock interest. The instrument was to have been ready some time ago, but has not yet been seen or heard from. W. T. H.

NEW ENGLAND NOTES.

PROVIDENCE, R. I., March 15, 1886.

The R. I. Braiding Company reports a satisfactory increase in recent sales of its machines for braiding wire. This company has recently added several valuable improvements to its machines, greatly enhancing the quantity as well as the quality of the work turned out by same.

The Providence Electrical Supply Company, for several years located at No. 56 Washington street, this city, has moved into larger and roomier quarters, No. 59 South Main street. The company desires the attention of inventors and manufacturers of electrical novelties drawn to its peculiar facilities for introducing that line of goods throughout Rhode Island.

Messrs. Geo. H. Adams & Co., electric engineers, No. 174 Broad street, this city, have their store stocked with a full line of electrical instruments and supplies. The firm are devoting much of their time to equipping and wiring electric light plants and constructing private telephone lines. Recently Mr. Adams has been making tests and measurements of the efficiency of several of the electric lighting systems, and his knowledge and experience as an expert electrician well fit him for this kind of work.

Mr. W. O. Talcott, of this city, manufactures belt hooks which really deserve attention from superintendents and managers of electric light stations. The "Combination" belt hooks are intended for all ordinary belts running over pulleys as small as 2 inches in diameter, and running at as high a speed as two thousand revolutions per minute. They are said to have an advantage over any fastener yet made, for they can be used over as many times as you wish to take up your belt, and yet they are firmly clinched into one end of the belt, and can never fly out. There is no metal to come in contact with the pulley.

The Armington & Sims Engine Company has just finished a number of automatic cut-off engines for shipment abroad. Since the beginning of the year, the company has been constantly making additions to its facilities for manufacture and to its working force, and yet reports being behind in orders. W. I. B.

WORCESTER, Mass., March 16, 1886.

Messrs. Wm. Allen & Sons, proprietors of the Worcester Steam Boiler Works, enjoy the reputation of being manufacturers of a fine grade of tubular boilers. This firm had the contract from the Worcester Electric Light Company for fitting up its plant with the entire equipment, and it is said to be one of the most economical plants of its size in the country. They have fitted up a large number of plants for various purposes, and have contracts now in hand for fitting up steam plants in Philadelphia and Wilkesbarre, Pa.; Montgomery, Ala., and San Diego, Cal.

Messrs. W. C. Young & Co., the well-known lathe manufacturers, have recently added several new features to their machines, and now have a number of the improved pattern ready for shipment.

Messrs. Reed & Page, the electricians, are the recipients of a large and profitable patronage from the people of Worcester and surrounding country. The principal branch of their business is the fitting up of churches, public buildings, stores and residences with electric apparatus of any description. W. I. B.

NORTH ADAMS, Mass., March 17, 1886.

Messrs. James Hunter & Son, of this town, have received an order from the Dunnell Manufacturing Co., of Providence, R. I., to fit up their mills with Hunter's Patent Friction Clutch Pulleys and Cut-off Couplings. A number of these clutch pulleys and couplings are to be attached to the shafting from which are belted the dynamos of the electric light plant of the mills. From a careful examination I am convinced that this clutch combines simplicity, durability and great strength, and is adapted to either light or heavy work. It does away with all shifting of belts, and it operates quickly, starting or stopping machinery without shock or jar. W. I. B.

HOLYOKE, Mass., March 17, 1886.

The Amherst Hydraulic Motor Company, of this place, is to all appearances and report rapidly gaining a widespread reputation on account of the excellence of its water engines. In the issue of March 6 of THE ELECTRICAL WORLD, page 107, is published a letter from the Superintendent of the Water-Works, Lake View, Ill., in which the merits of the Amherst hydraulic motor are set forth; and it refers, also, to its adaptability to electrical purposes. The business of the company is so rapidly increasing that it has become necessary to put in additional machinery. W. I. B.

HARTFORD, Conn., March 18, 1886.

The Waterhouse Electric and Manufacturing Company, of this city, though but a new enterprise, has already made such rapid progress that most of the experimental work is at an end, and several dynamos, motors, lamps and other apparatus have been finished. In a very short time the company will have everything in readiness to enable it to place its system before the public. The promoters of the enterprise are gentlemen of wealth, who have been for many years prominently identified with the manufacturing interests of this section. The Ballou Manufacturing Company, one of the oldest concerns in this city, was merged into the corporation aforesaid about the same time that Mr. Waterhouse organized his company. The influence, manufacturing facilities and skilled workmen of the Ballou Manufacturing Company have already contributed considerably in pushing forward the enterprise to its present advanced stage. The manufacturing facilities of the Waterhouse Electric and Manufacturing Company are still further enlarged from the fact that the enormous machine and tool shops of the treasurer of the company, Mr. Mr. A. C. Cook, adjoin the other shop, and are at its disposal. This has already proven of benefit to the new company. W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
PHILADELPHIA, March 22, 1886.

The Knickerbocker Ice and Coal Company, of this city, have about completed their new building on Sixth and Arch streets. They have fitted it with the latest electrical appliances, the Brush Company having put in a 200-light incandescent plant. They also use the electric clocks, furnished by the Time Telegraph Company, of New York. Their telephone system is something unique, and is the idea of Mr. W. B. Wood, who is the electrical man of the company. Mr. F. A. Culin did the wiring of the building in an efficient manner.

W. T. Brown, electrician for the general offices of the Pennsylvania Railroad Company, is the inventor of a novelty in the way of an arrester for cables, telephone and telegraph wires. He is also the agent for Pennsylvania and other States for the Roberts permanganate battery, which he has adopted for his own use in making tests. Referring to the invention above, public tests will soon be made, and Mr. Brown extends a hearty invitation to all engaged in electrical matters, as he has great expectations for the efficiency of his invention.

A reorganization of the Clark Insulated Wire Company is being effected.

The Maintenance & Construction Company are getting ready for work the coming season. They anticipate a large amount of work in the underground business, as they have the oldest system here and one which has worked successfully in many places.

Shaw & Geary are busy manufacturing and working up new inventions for others.

In April of last year the United States Circuit Court granted a restraining order to the American Bell Telephone Company restraining the Clay Commercial Telephone Company from carrying on its business, and, after hearing argument, reserved its decision in the case. Counsel for the Clay Commercial Company, on Saturday last, filed a petition asking to have the restraining order revoked and annulled, and a decision in the suit postponed until such time as the suit to be instituted by the United States against Alexander Graham Bell, involving the validity of the latter's patents, shall be determined. No further action was taken than the filing of the petition.

Last Saturday evening, Daniel Coyle was instantly killed while making an electric light wire connection in front of Joseph Bell's shoe store at 1116 North Second street. The electric lamp had set fire to the awning, and Coyle, who was in charge of the dynamo room at the Northern Electric Light Company's works, was dispatched to attend to the wire, which was out of order. The electric current was shut off on that circuit and he was at work on the bulkhead of the show window, making the temporary connection, when some one shouted from the pavement that the current had been turned on again. Coyle remarked, "If they had let it alone a minute longer I'd have been done," and toppled over with a groan on the awning. Young Bell, who was near him at the time, caught hold of his limp body and attempted to raise him, but receiving a violent shock desisted. The senior Bell and others on the sidewalk promptly raised a stepladder and lowered the body, which was taken to an adjoining drug store, but found to be lifeless. Deceased was regarded as an expert electrician, having been employed for some time by the Brush Company before coming to the Northern.

Henry G. Rees, formerly at 730 Sansom, has removed to 23 and 25 South Fourth, where in connection with P. J. Fitzgerald he has formed the Eureka Electric Light Co., whose intentions are to furnish complete electric light plants. E. F. I.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, March 20, 1886.

The electrical event of the week occurred yesterday, and consisted of an exhibition test of the Edison system of sending and receiving telegraphic messages on trains while in motion. Shortly before eleven o'clock some two hundred gentlemen, representing railroad, telegraph, telephone and other interests, boarded a special train at the Union depot and left for Milwaukee, between which city

and Chicago the test was to be made. Those present (including your correspondent) were the guests of the Edison Railway Telegraph & Telephone Company and the Chicago, Milwaukee & St. Paul Railway Company, from whom invitations to witness the exhibition had been received early in the week.

The Edison company's apparatus was in the baggage car, which became the centre of interest, of course, immediately the train started. It is not necessary to describe this apparatus to your readers, as the whole Edison system was illustrated and described in the WORLD only a short time since. It was very evident that the interest was not less among those who understood the theory of the system than among those who were entirely ignorant in this respect, for the baggage car, during the whole of the eighty-five mile run from Chicago to Milwaukee, was crowded to suffocation, so eager was the desire to see the instruments actually at work. Some two or three hundred messages were received and sent from the train, many of those received being from far distant points—Kansas City, Cleveland, Cincinnati, Detroit, New York and other cities. In quite a number of instances guests were agreeably surprised at receiving actual business messages, which were sent them by those with whom they had business relations, as soon as it was telegraphed out that the system was doing all that had been claimed for it, and that the exhibition test was proving successful. One gentleman, a branch of whose business is in Milwaukee, dropped into his company's office there, and requested them, in case they should hear anything definite concerning a certain matter about which they had been conferring, to telegraph him, giving his address on the special train returning to Chicago. Aboard the train talking with friends, the matter had escaped his mind and was well nigh forgotten when a telegram was put into his hand, which upon opening, he was very much surprised to find contained the information he had requested to have telegraphed him from Milwaukee. It became evident in fact, long before the trip was over, that the system was working splendidly, and that messages could be sent to or received from any point. All messages were obliged, of course, to go through a station whose telegraph office was supplied with the induction apparatus, and on this account all of the messages reached or left the train through Wadsworth, Wis., a station just about half way between Chicago and Milwaukee, which had been equipped for the purpose. Going up, the train had run at the rate of only about thirty miles an hour, but on the return trip much faster time was made, but the speed of the train did not affect the working of the apparatus.

On the return trip it was evident that most of the passengers had to a large extent satisfied their curiosity in regard to the instruments and as to whether the system would work or not, and little groups could be seen scattered over the train discussing the possible applications of the system. That it would work, at least under fairly favorable circumstances, the day's experience had shown them. But could it be developed into a thing of practical utility? Then, too, would the system work through tunnels? Would it work over high embankments, where the wires were below the track? Would it work in large railroad yards filled with cars? Questions like these, and much other speculation, occupied the attention of the experts on the return trip; but on one thing they were all agreed, that everything claimed for the system in the present stage of its development had been performed and very successfully on this trial trip.

Just before reaching Chicago, on the return trip, a series of resolutions were drawn up and adopted by the passengers in their capacity of guests, thanking the two companies for their courteous treatment, and congratulating them on the successful test. The guests turned out of the train at the Chicago depot a little before 6 P. M., after having spent a very interesting, profitable and enjoyable day.

W. A. K.

SOUTHERN NOTES.

MEMPHIS, Tenn., March 15, 1886.

I am happy to report that Memphis is keeping up with her neighbors in electrical matters.

The Baltimore & Ohio Telegraph Company has just opened an office for business on Madison street, having secured the one formerly occupied by the Western Union Company, which moved to new quarters in the Cotton Exchange Building, corner of Second and Madison streets, about the 1st of January. The Baltimore & Ohio Company was fortunate in selecting so good a location for business, and it has spared no expense in fitting it up with all the modern improvements in the way of desks, furniture, etc.

On Thursday last one of Day's Kerite five conductor cables was successfully laid across the Mississippi River to Arkansas for this company. It works finely. A double line of No. 12 copper wire has also been strung along the Memphis, Springfield & Kansas City Railway to Jonesboro, Ark., where connection is made with their union line out of St. Louis.

The Brush Electric Light and Power Company, which has been very successful here, has about fifty arc lights in operation, and it is lighting several stores with incandescent lamps.

The Gayoso Hotel Company has just entered into a contract with the Edison Electric Light Company to light its magnificent hotel with arc and incandescent lights; and a new company has also obtained a charter and will be in operation in a few weeks, using the Edison lights on our streets and in buildings.

The Cumberland Telephone Company now has over one thousand telephones out in this city, and, under the management of Superintendent Cook, all are giving good service. This company is suffering considerable loss in Idniana, however, where it has several exchanges and many territorial lines.

The Pan-Electric Telephone Company is doing nothing at present.

The Western Electric Company, of Chicago, has purchased a large quantity of very valuable walnut timber twenty miles below here in Arkansas. It will be moved through Graves, Frenchman's and Blackfish bayous and the St. Francis River, whence it is to be taken to New Orleans by tow boat, from which city it is to be shipped to Belgium, to be used in the manufacture of telephones for that country. Mr. H. D. Gill is watching the movement of this timber for the company.

Messrs. Schmidt & Son are doing considerable electrical work in the city and vicinity, and it gives general satisfaction.

R.

THE TELEGRAPH.

Three Dollars a Week.—The Government Telegraph office in England advertised recently for sixty telegraph girls, at $3 a week. There were no fewer than 1,200 efficient applicants.

Joining the Knights of Labor.—It is said that the operators, through the Telegraphers' Protective Union, will again, as a body, enter the ranks of the Knights, and that a large number of operators are already in the order.

Signal Service Lines.—Lieut. J. M. Woodruff, of the United States Signal Service, has begun the construction of land lines of Signal Service telegraph to Martha's Vineyard and Nantucket. The cables were laid last November. He expects to finish in four weeks.

Fair Treatment.—The several hundred telegraph operators on the line of the Philadelphia & Reading Railroad Company have been informed that their salaries will be increased to the amounts paid prior to January, 1885, at which time a reduction of 10 per cent. was made.

A Short Cut to Matrimony.—Girl telegraph operators and shorthand writers, says "Halston" in the New York *Times*, are to be found in nearly every leading stock broker's office in Wall street now. Fair salaries and a short cut to matrimony are the temptations which some of the fair ones see. A broker whose home formerly was in the West, announces to his friends that after Lent he will marry the pretty girl who has been his telegraph operator and private secretary for the last year or so.

Train Telegraphy.—The exhibition of the working of the Edison system of telegraphing to and from moving trains, by induction from the roof of the cars to the wires, was again given on March 19, on a special train run by the Chicago, Milwaukee & St. Paul road from Chicago to Milwaukee and return, and was very successful. Sealed messages, written by and addressed to the passengers, were sent by the Morse system from Chicago to the point where condensers for the new system were placed, and from there they were telegraphed to the operator on the train, running 35 miles per hour, and delivered to the writers. See our Chicago correspondent's letter.

T. M. B. A.—Mr. C. W. Hammond, Superintendent of Telegraph of the Missouri Pacific Railway Company, is sending out to Western telegraphers 1,500 circulars advocating membership in the T. M. B. A. The circular is admirably put. One paragraph says: "It is indorsed by many of the most prominent men in the telegraph service. Among the well-known telegraphers in the West who are members of the association are R. B. Gemmell, Superintendent A., T. & S. F. R. R.; H. C. Sprague, Superintendent K. C., Ft. S. & G. R. R.; D. K. Smith, Superintendent M. & K. Telephone Co.; E. H. Perry, W. H. Woodring, D. E. Martyn, Joseph Houston, D. A. Carroll, T. F. Clohesy, C. Dougherty, R. H. Behle, E. H. Brown, J. H. Topliff, and L. C. Baker, Superintendent W. U. Telegraph Co."

THE TELEPHONE.

American Bell.—The annual meeting of the company will be held at the Meionaon, Boston, March 30, the books closing March 29.

Vienna to Pesth.—It has been decided to undertake experiments with a view to establishing telephonic communication between Vienna and Pesth.

Investigating Pan-Electric.—The investigation of the Pan-Electric telephone scandal is still going on. Dr. J. W. Rogers and Col. Casey Young have been on the stand before the committee of the House of Representatives, detailing the particulars of their connection with the company, as well as the relations borne to it by various officials and politicians. It appears from the testimony that several Congressmen were very anxious to get a stock interest in the concern. Part of the testimony goes to establish the fact that there were negotiations with the Bell Company for a sale of Pan-Electric, but there is no proof that the Bell people had any very great yearning or hankering after the property.

"Mustn't Speak to the Man at the Wheel."—The recent London riots have developed some rather astonishing facts regarding the Scotland Yard police regulations. It seems that although there is a telephone connection between Scotland Yard and the public telephone office, no private person is allowed to ring up the police office. Thus when the first club window was broken at the beginning of the riots, several persons at once attempted by telephone to warn the police of the outbreak. Scotland Yard refused, however, to receive their messages, and therefore did not hear of the riots until after all the damage had been done.

The Wallace Telephone.—The Ottawa *Journal* says: "Mr. Wallace, whose New York company is supplying the instruments for the new telephone to be established in this city, is expected to arrive at the Russell to-day. The first consignment of instruments, about three hundred in number, has reached here and they will be placed in position without delay. Mr. Wallace will supervise the work. A central office has been obtained and Senator Clemow says he is confident that the service will be inaugurated within three weeks. The number of subscribers is already between three hundred and fifty and four hundred." The Wallace telephone is to be used also in Winnipeg by the Manitoba Telephone Company.

The Telephone at Oxford University.—A hot dispute is raging in Oxford between the Postmaster-General and the college authorities, which, says the *Pall Mall Gazette*, threatens first to destroy one of the most convenient institutions of the university and then to introduce a destructive innovation. The delivery of notes by college messengers and by the "Union" is one of the conveniences of Oxford life, but the Post Office has become alive at last to the fact that it constitutes a serious infringement of its monopoly. Matters have not been pushed to an extremity, but the college authorities are already preparing for the worst by obtaining estimates for the introduction of the telephone. Unless the wires are to be all under ground, the remedy will be worse, many people will think, than the evil. Better have no means of immediate communication at all, they are already beginning to say, than "a network of wires across the fronts of our finest buildings."

The National Telephone League.—A dispatch of March 18 from Indianapolis says: The National Telephone League, of Boston, Mass., is flooding this city with circulars calling attention to the fact that the league is an organization of citizens determined to resist the telephone monopoly at every point, that there is reason to believe that the threatened withdrawal of telephone service from this State on the plea of inability to operate under the Williams bill is really intended to influence legislation in other States by preventing the passage of bills of a similar import, more particularly in Iowa, New York, New Jersey, Connecticut and Massachusetts. Accompanying these circulars are petitions addressed to the United States Senate and the House of Representatives, asking the representatives of Indiana in these bodies to make inquiry whether the telephone service rendered by the American Bell Telephone Company or its agents is being discontinued in whole or in part in this State, or in any other State, for the purpose of influencing legislative or judicial action; also whether such discontinuance for such purpose is the result of combination between such telephone companies. These petitions are now being distributed, and so far as heard from are receiving many signatures.

THE ELECTRIC LIGHT.

The Greencastle Electric Light Company, of Greencastle, Ind., has a capital stock of $25,000. Mr. Geo. Hathaway is one of the incorporators.

Easton, Pa.—The Committee of City Council appointed to investigate the subject of electric lighting, with a view to adopting a system, has recommended the Knowles-Moffat system of the Brooklyn Electric Construction Company—three 60-light dynamos, &c., for $14,400.

Lighting from Primary Batteries.—Speaking last week in regard to the work of the Chemical Electric Light and Power Company, in Boston, one of the officers said: "Our dark room, in which we show our incandescent lamps run by Volta-Pavia primary batteries, is thronged from morning to night. There is no question about the demand for the solution; the only question is our ability to fill orders."

Relative Cost of Different Sources of Light.—Lecturing recently at Stafford on "Sources of Light," Prof. W. F. Barratt, F.R.S.E., of the Royal College of Sciences, Dublin, comparing the different illuminating agents in use at the present moment, said that for the same amount of light, gas cost 12 cents, the glow electric 12 cents, and the arc 6 cents. Paraffin oil occupied a very high position as an illuminant in cheapness and undeleterious nature of waste products, but its disagreeable smell and the danger attending its use were against it. Electricity gave rise to no deleterious products at all, but the arc lamp gave a dazzling light, throwing intense shadows. In calculating the cost of providing the electric light for a house, the chief item was the interest on capital laid down in plant; the actual supply of electric energy was the least of the items. For 200 lamps lighted 500 hours a year, it was cheaper to have gas than the arc electric light. But in gas the chief cost was the consumption of gas, and when the number of hours a year in which the light burned was extended, the relative cost of the two systems was reversed. The great requisites for an artificial light were steadiness, accessibility, cheapness, safety, non-deleteriousness, and whiteness.

APPLICATIONS OF POWER.

For Working Guns.—Electricity is successfully employed to work a twenty-two-ton gun in a foundry at Castelamare, Italy. The question of training and working heavy guns by means of electrical motors has for some time occupied the attention of the English War Office authorities, who have carried out a series of experiments. The system of employing small motors, actuated by a dynamo machine driven by a steam engine placed under cover in a sheltered position, will probably be adopted in preference to the present plan of transmitting the motive power by means of shafting. It is understood that the guns of the Spithead forts are to be immediately fitted with the new electrical training gear.

PERSONALS.

George H. Corliss, the engine builder of Providence, R. I., has received from the King of Belgium the cross of the Order of Leopold, in recognition of his distinguished services in mechanical engineering.

Edison Amid Orange Groves and Blossoms.—"We are rather scared about Edison," said one of his electrical associates to a New York newspaper man the other day. In reply to questions, he continued: "We haven't heard a word from him. It is three weeks now since he married, and he has taken no notice whatever of us in all that time. We have written to him. We have telegraphed him. We get no response. He has cut us dead. We ask him questions requiring immediate attention, and that is the last of it. We are running the concern without him. He ignores the telegraph and despises the mail. It doesn't look as if his young wife had a rival in science or was being neglected for any new-fangled contrivance, does it? If we don't hear from him pretty soon we shall send an ambassador down there or a thoroughly equipped committee."

The Prince's Friend, Bigelow.—Writing from London to the New York *World*, J. H. Copleston says: I must not omit to mention one of the most conspicuous members of the American colony, Mr. John P. Bigelow, of Cromwell road, South Kensington, who desires to be known as "the Hon.," but who is not to be confounded with the Hon. John Bigelow, the ex-Minister to Paris. John P. is one of the most hospitable and generous of men. On a summer's afternoon, when transient Americans are in season here, he may be found entertaining them at the Grand Hotel bar with words of worldly wisdom, with marvelous tales of his eventful life, and with whatever concoction may be the "particular vanity" of his wondering guests. He is believed to be a man of vast wealth, one source of which is a telephone company, whose chief offices are in Victoria street. But his wealth bears no comparison with his social position. He talks familiarly of "his friend the Prince," and confidently confesses that his intimate friend, the Queen, finds great comfort in the advice he has given her since the death of Prince Albert.

MISCELLANEOUS NOTES.

Erratum.—In our last issue an error occurred in Mr. Carl Hering's article on the Winding of Field Magnets. In the last line of the fifth paragraph from the end (p. 182,

the words *obtained from (a W)* should read *obtained from (a W")*.

Executions by Electricity.—Senator McMillan has introduced in the New York Legislature a bill which provides for the appointment of a commission to investigate and report the most humane method of inflicting capital punishment. The bill is probably the result mainly of the efforts of Dr. A. P. Southwick, of Buffalo, N. Y., who has been for many years anxious to have the method of capital punishment changed; and of Assistant-District Attorney Quinby. They look upon hanging as a relic of barbarism. Science is so far advanced that other and better means can easily be devised. Dr. Southwick proposes to execute criminals by means of electricity, by which death would be instantaneous. The method which he proposes is very simple. His idea is to use an ordinary chair to which a wire could be run from the electric light works. The man would sit in the chair with his head resting against its back. The wire entering an insulated substance, such as rubber or glass, would constitute the positive pole. By placing the man's feet upon a metallic plate a connection would be formed with the poles. At a signal a switch in another room could be turned. The current would enter at the base of the brain, the centre of the nervous system, and pass through the man. The heart would stop beating, and a complete paralysis would ensue.

SPARKS AND FLASHES.

But He has an Underground System.—The much detested telegraph wire saved the lives of nine firemen at a Montreal conflagration, by preventing the falling of a ladder. Give Satan his due.—*Boston Globe.*

What Is the South Pole?—A clergyman has been converted to President Warren's idea that the North Pole is the seat of Paradise, and carries around with him a miniature compass, so that the needle may always point in the desired direction.—*Chicago Living Church.*

A Compound Cathartic.—A Florida farmer claims that it is biliousness that makes a man fret and swear, and he always takes a compound cathartic pill when feeling out of humor, and it always sets him to rights. A Tapville man read this item and then placed a pailful of pills and a tin cup alongside his telephone. His druggist is about to build a handsome brown stone front, it is rumored.—*Peck's Sun.*

The Anti-Tramp Protector.—A recently-married electrician who lives near Sacramento, Cal., has devised a scheme for protecting his wife from the annoyance of tramps. The vagrants invariably sought the kitchen via a rear stairway, so the electrician detached the four bottom steps from the others and attached a powerful battery to them. A wire from the battery runs into the kitchen, and when a tramp is seen approaching, all that is necessary is to touch a spring at the proper moment, and the astonished seeker after provender is thrown nearly over the back fence.

Why not Moustaches?—An interesting experiment, showing the influence of electricity on the growth of roots, has been made in Germany by Professor Hodefiess. Plates of copper were thrust upright into the earth and connected by wires with similarly-placed zinc plates about 100 feet distant, an electric battery being thus formed, with the earth between the copper and zinc in the circuit. Both potatoes and beets planted between such plates gave an increased yield—beets, fifteen per cent.; potatoes, twenty-five per cent.—as compared with other parts of the same field.

The Tattling Telephone.—Young swell at telephone—"Are you disengaged for this evening, Miss Jones?"

Faint voice—"What do you say?"

Young swell—"Will you be engaged this evening?"

Faint voice—"What's that you say?"

Young swell (slowly)—"Will your time be occupied this evening?"

Faint voice—"I can't hear you."

Young swell (very loud)—"Are you working to-night?"

Faint voice—"Yes."

Young swell—"All right, then. I'll come down to the store."

Chorus of haw haws from his listening friends.—*Chicago Mail.*

"Caviare to the General."—When Bill Nye wrote his celebrated account of how the brakeman of No. 10 woke him up at midnight and told him in the wonderful language of the railway all about the progress and conditions of the trains, Bill told him to keep right on with that beautiful jargon of the road, and by and by he would get so that no one on earth but a railway man would understand a word that he said. It is curious to note how every new invention that comes into general use brings into the language a great number of new words. Some of these become assimilated into everyday lingo, and others remain a mystery to all but the initiated. An example of this has just been received at the *Free Press* office in the shape of a circular from the United States Electric Lighting Company. It is on the subject of meters. The circular talks of "indications of permanent magnet ammeters and voltmeters," of "standardization," of "current and potential," of "arc and incandescent installation," of "reducing the value of the constant," of "dynamos" and "ohms" and "volts," of how instruments are "calibrated," of "percentage change" and of "the value of the scale division." As far as the general reader is concerned, this circular might have been written in Sanscrit or Chinese.—*Detroit Free Press.*

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—B. & M., b 2, a 3; Com. Tel., b 30, a 40; Western Union, b 63¾, a 63¾.

Telephone.—Am. Bell, b 158, a 159; New England, b 31, a 31¼.

Electric Light.—No new quotations.

BUSINESS NOTICES.

Gaiffe Batteries.—Waite & Bartlett have half a dozen real Gaiffe double-cell pocket batteries worth at least $6 each, which they will dispose of for $3.50 each.

Chromic Acid Crystals.—The Chemical Electric Light and Power Company, 95 Milk street, Boston, will furnish pure chromic acid crystals at 75 cents per pound, and crude for battery use at 25 cents per pound.

Steam Boiler Inspection and Insurance.—The Hartford Steam Boiler Inspection and Insurance Company not only makes careful periodical inspection of boilers, but guarantees against loss from explosions. The boilers insured are regularly visited and tested, as well as their appliances. The policy of insurance issued by the company can also be made to cover death or personal injury. The terms offered are deserving of the consideration of all steam users, in which category so many electricians and electrical manufacturers now find themselves.

A Warm Testimonial.—The following speaks for itself:

SALT LAKE CITY, March 6, 1885.

JEROME KIDDER MANUFACTURING COMPANY:

DEAR SIRS: Please forward me one No. 4 Office and Family Apparatus, also one of Dr. Tipton's books. I received the others all right. Please send them by express, C. O. D. The apparatus I received for myself is giving perfect satisfaction in my office. I have had no trouble whatever, and if it were impossible for me to get another like it $5,000 would be no temptation for me to part with it. Yours truly, DR. H. E. GROW.

Glenn's Sulphur Soap
Heals and beautifies, removes pimples and blemishes; 25c.
GERMAN CORN REMOVER kills corns and bunions; 25c.
HILL'S HAIR AND WHISKER DYE, black and brown; 50c.
PIKE'S TOOTHACHE DROPS will cure in one minute; 25c.
DEAN'S RHEUMATIC PILLS are a prompt, sure cure; 50c.
HALE'S HONEY, the great cough cure, 25c., 50c. and $1.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED MARCH 9, 1886.

337,385. Electric Regulator for Pendulum Clocks; Sylvester Eastman, Providence, R. I., Assignor to the Synchronous Time Company, Portland, Me. Consists of a movable frame upon the pendulum, adapted to be moved by electricity to change the length of the vibrating portion.

(1) 337,416. Means for Regulating Pendulum-Clocks from a Distance; (2) 337,417. Means for Regulating Pendulum-Clocks from a Distance; (3) 337,418. Means for Regulating Marine Clocks from a Distance; (4) 337,419. Apparatus for Regulating Pendulum-Clocks from a Distance; George W. Millard and Joseph H. Clarke, Providence, R. I., Assignors to the Synchronous Time Co., of Portland, Me. (1) Vibrations of the pendulum of a secondary clock are kept synchronous with those of the master clock by devices actuated by electric connections controlled by the latter, which at predetermined times act to raise or lower the centre of an oscillation, as may be required to accelerate or retard the beat.

(2) Electric devices are controlled by a master clock, and so connected with the pendulum of the secondary clock that its vibrating length may be automatically varied to cause acceleration or retardation, as may be required.

(3) Electric devices are controlled by a master clock and applied at predetermined times to increase or diminish the vibrating length of the balance-spring.

(4) Consists of modifications of the above inventions.

337,439. Fire-Telegraphy; Sidney J. Sanford, Barrie, Ontario, Canada. As shown in the cut, it embraces a numbering apparatus provided with the electro-magnet *R R*, lever *X*, fly-stop *o*, and escapement *z*, intermittingly released by said lever to control the numbering discs.

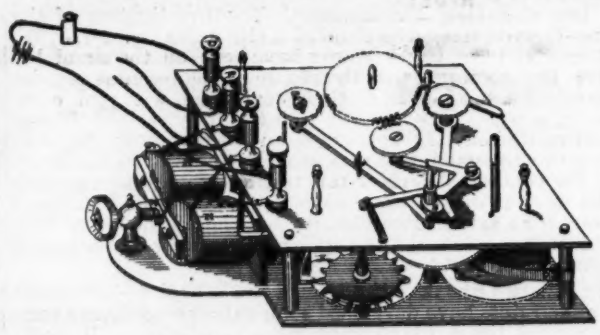
337,477. Galvanic Battery; Horatio J. Brewer, New York, N. Y. The negative electrode consists of a horizontal plate of carbon, a vertical plate or plates of carbon or material containing carbon, and a horizontal plate of carbon placed above and upon the vertical plates, the plates being forced together by screw-pressure.

337,558. Armature for Dynamo-Electric Machines; Carl Coerper, Cologne, Germany. Consists of a flat-ring armature for dynamo-electric machines, which is made of a closed ring-shaped hollow frame, around which is wound a filling of insulated wire, said frame being tapering at the inner end and inclosed at the three sides by the pole-pieces of the field-magnets. The flat rings are supported on a disc or web of paper attached to the shaft of the armature.

337,583. Secondary Electric Clock; Vitalis Himmer, New York, N. Y., Assignor to the Standard Electric Clock Co., same place. Embraces a motor consisting of a ratchet and pawl, and connected by a double-jointed lever to an operating armature, and a back stop or lock.

337,590. Telegraphic Repeater; Joseph K. Olzer, Duisburg-on-the-Rhine, Germany. Consists of helices and armature-lever of a relay and the contact-screws, spring-arm, separate from the armature-lever, contact thereof, metallic piece, hook-shaped extension thereof, contact in said extension, binding-post, binding-screw, plate, yielding conductor connecting plate with screw, and insulated point of contact-screw.

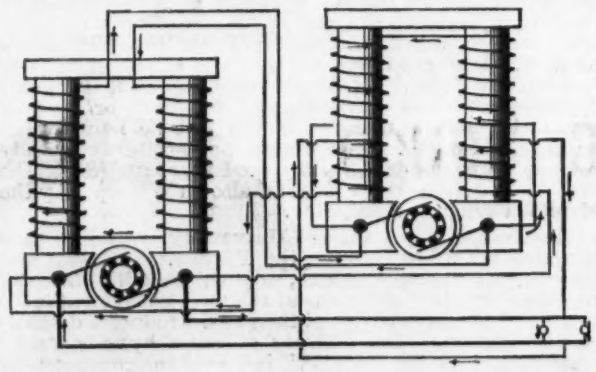
337,624. Underground Conduit for Electric Wires; John J. Schillinger, New York, N. Y. It is composed of an exterior trough, having a cover and semi-circular bottom wall, the interior trough supported within the outer trough to form a continuous intermediate air-space



337,439. FIRE TELEGRAPH.

on all sides; said interior trough being provided with a cover, and having a continuous series of transverse perforations in its side walls and vertical perforations in its bottom wall, and horizontal and vertical pegs, supported in said perforations respectively.

337,626. Signaling Apparatus; Leopold Sellner, Vienna, Austria-Hungary. Consists of several parts, viz., first, the source of electricity or generator, which may



337,628. REGULATOR FOR DYNAMO ELECTRIC MACHINE.

be either a primary or a secondary battery or accumulator or a dynamo or magneto electric machine; second, a system of contact makers or switches so constructed that upon shifting one of the same by means of a key or handle a definite combination of signaling electric lamps will be thrown into circuit, and thereby a definite signal will be given; and third, a series of electric lamps, preferably incandescent lamps, placed on a signal mast or in the rigging of a vessel or in any other suitable position.

337,628. Regulator for Dynamo-Electric Machines; Oliver B. Shallenberger, Rochester, Pa. The disposition of the circuits is as shown in the cut.

337,679. Electric-Current Meter; John J. Green, Boonton, N. J. Consists of an adjusting device for two electrodes terminating in a U-tube provided with a scale for indicating the loss of electrolyte.

337,737. Electric-Arc Light; William F. Bulkley, Cleveland, O., Assignor of two-thirds to L. E. Holden and Eugene H. Cowles, both of same place. Consists of the operating-lever of the feeding mechanism which separates the carbons, of a magnet placed in the shunt-circuit, and an armature adapted to lock the operating feed-lever when the latter has once been brought into action.

337,753. Diaphragm for Telephone-Receivers; North Dowling, Philadelphia, Pa. Consists of a compound plate in which are combined a substance—such as iron—adapted to be attracted by the usual magnets of telephone-receivers, and material—such as vulcanized rubber—possessing a high vibratory or resonant quality.

(1) 337,775, (2) 337,776. Regulator for Dynamo-Electric Machines; (3) 337,777. Electric Motor; Osborn P. Loomis and Henry W. Cooley, Lynn, Mass. (1) See illustrated article. (2) Among the claims they have the following: In combination with the armature and field magnets of a dynamo-electric generator, a variable resistance and electric automatic operating mechanism therefor, both located in a shunt circuit to said armature, the lamps or other translating devices being in series with said field magnets. (3) This consists principally of an armature upon which the claim is for four windings at right angles and at the same time parallel, there being two pairs of parallel coils at right angles to each other.

337,778. Regulator for Dynamo-Electric Machine; Richard H. Mather, Windsor, Conn. Consists of a detractor and a magnet having constantly-closed circuit-connections and being placed one in the main or working-circuit of the machine, and the other in a derived circuit about the work.

337,793, 337,794. Electro-Dynamic Motor; Frank J. Sprague, New York, N. Y. They relate to means for short circuiting the motor or elements thereof, and the principal means consists of a movable terminal of the supplying-circuit, a contact therefor whereby the whole motor may be short-circuited, and a contact whereby the field-magnet alone may be short-circuited.

337,796. Electric Mail Box and Indicator; Henry F. Staus, Chester, Pa. Relates to apparatus for signaling from a mail-receiving box to a point in the building where such box is located when a letter is deposited in such box, and for indicating when the owner of the box is within or without the building. It consists in a mail box or receptable containing three revolving contact-buttons of similar construction operated by a removable key, with an indicator operated by two pairs of magnets controlled by the two lower revolving buttons and a series of circuit-wires leading thereto from the source of electric supply.

337,797. Self-Winding Electric Clock; D. Fred. Sweet, Grand Rapids, Mich., Assignor by direct and mesne assignments to the Electric Time Company, of same place. A circuit closed by the action of the train at regular intervals causes the main spring to be wound a little faster than it unwinds on the running of the clock.